C. I. BABCOCK

Vol. 52 No. 1 July 1958

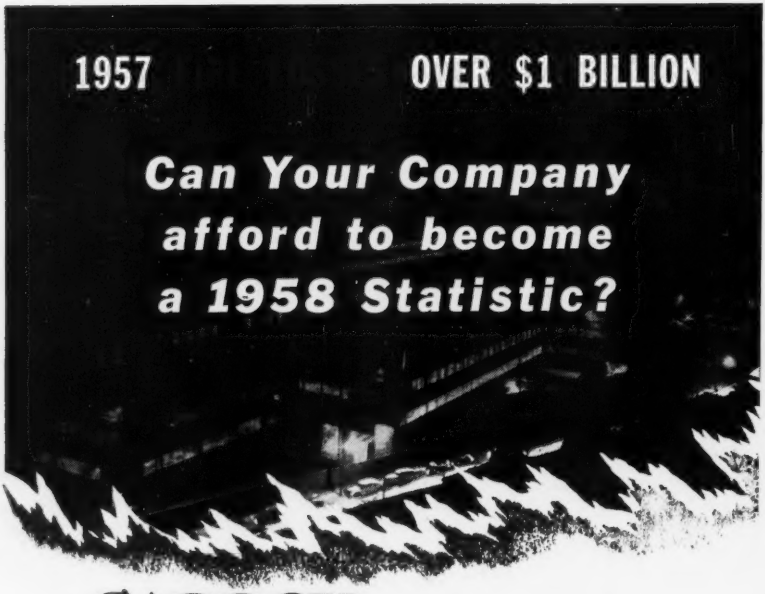
Quarterly

of the

National Fire Protection Association

INTERNATIONAL

Promoting the Science and Improving the Methods of Fire Prevention and Protection Since 1896



CARDOX Systems offer
'ROUND THE CLOCK PROTECTION
from FIRE LOSSES

It makes little difference whether the record "large fire" losses of 1957 were due to increased hazards or to steadily rising costs; no company can afford to let fire put them out of business in 1958, or at any time in the future.

CARDOX Low Pressure Carbon Dioxide Systems minimize the danger of high loss fires by providing instantaneous, fire-smothering protection for "hot spot" hazards, or entire plant facilities.

In addition to 'round-the-clock, positive protection, a CARDOX System offers other advantages at no extra cost. These include: Design and engineering experience that means maximum, individualized protection for your particular hazards. Plus, prompt nation-wide recharging service.

The people of CARDOX are Carbon Dioxide Specialists. Be sure you are getting all the extra advantages of proven engineering, research, experience at no extra cost. It pays to specify "CARDOX ONLY."

*Covered by U.S. and Foreign Patents, Issued and Pending.

CARDOX CORPORATION

307 N. Michigan Avenue • Chicago 1, Illinois

District Offices in Principal Cities

Vol. 52 No. 1 July 1958

Quarterly

The Standard Technical Journal of Fire Protection for More Than Fifty Years

The NFPA is a non-profit technical and educational organization devoted to the reduction of loss of life and property by fire with a total membership of 17,000. The *Quarterly* is one of the publications regularly provided to members. Other membership publications include *Fire News*, *Advance Reports* to the Annual Meeting, a *Year Book*, and many leaflets, pamphlets and posters issued throughout the year on fire prevention and control. Six volumes of the National Fire Codes are available on an annual subscription basis, one volume free and others at reduced membership rates. For full details on available material ask for the free "List of NFPA Publications."

NFPA annual dues are $15.00 for Associate Membership of which $6.00 is for subscription to this Journal. National and regional societies or associations may apply for an organization membership for which annual dues are $100; such a membership entitles four individuals to receive the periodical membership publications.

Technical committees of the Association develop means to safeguard life and property through the publication of standards covering all phases of fire prevention and protection. Your membership in the Association affords an opportunity to keep abreast of these developments and, by being a member, you help support this humanitarian activity. Popular educational literature on fire safety is constantly being produced by the NFPA for distribution through its members to the general public.

National Fire Protection Association

International

60 Batterymarch Street **Boston 10, Mass., U.S.A.**

Entered as second-class matter December 15, 1928, at the Post Office at Boston, Mass., under act of March 3, 1879.

Printed in U.S.A.

National Fire Protection Association

International

Officers

HENRY G. THOMAS, *President*, Chief, Fire Department, Hartford, Connecticut

LOREN S. BUSH, *Vice-President*, Chief Engineer, Board of Fire Underwriters of the Pacific

J. SHARP QUEENER, *Vice-President*, Manager, Safety & Fire Protection Division, E. I. du Pont de Nemours & Company

HOVEY T. FREEMAN, *Secretary-Treasurer*, President and Treasurer, Manufacturers Mutual Fire Insurance Company

Board of Directors

The Officers and

T. SEDDON DUKE, *Chairman*, President, Star Sprinkler Corporation

JOHN A. NEALE, *Past President*, Chief Engineer, National Board of Fire Underwriters

DALE K. AUCK, Director, Fire Protection Division, Accident and Fire Prevention Department, Federation of Mutual Fire Insurance Companies

WARREN J. BAKER, Manager, Technical Department, Insurance Company of North America

W. H. BERRY, Vice-President, America Fore Insurance Group

CHARLES H. BUNN, JR., Staff Consulting Engineer, Esso Research and Engineering Co.

MARSHALL B. DALTON, Chairman of the Board, Boston Manufacturers Mutual Insurance Company

W. H. FORRISTALL, General Manager, Factory Insurance Association

A. LESLIE HAM, Manager, Dominion Board of Insurance Underwriters

CLARENCE W. HIGBEE, Assistant General Manager, Electrical Conductor Division, Kaiser Aluminum and Chemical Corp.

PAUL C. LAMB, Safety Administrator, Lever Brothers Company

JEROME LEDERER, Managing Director, Flight Safety Foundation

WILLIAM L. MILLER, Chief Engineer, Department of Fire, City of Los Angeles

JOHN H. REDMOND, Vice-President and Manager of Operations, Tar Products Division, Koppers Company, Inc.

GEORGE J. RICHARDSON, Silver Spring, Maryland

LEIGH R. SANFORD, President, Shipbuilders Council of America

UDELL C. YOUNG, Vice-President, General Foods Corporation

Staff

PERCY BUGBEE, *General Manager*

CHESTER I. BABCOCK, *Manager, Fire Record Department, Chemist*

HORATIO BOND, *Chief Engineer*

MARGUERITE C. CHAFFIN, *Editorial Assistant*

PHYLLIS L. DEPLOEY, *Asst. to Technical Secretary*

DOROTHY H. ERNST, *Editorial Assistant*

BEATRICE L. FINLEY, *Office Supervisor*

HENRY S. GERE, *Advertising Manager*

CLARK F. JONES, *Gases Field Engineer*

WARREN Y. KIMBALL, *Manager, Fire Service Department, Editor, Firemen*

PAUL R. LYONS, *Assistant Manager, Fire Service Dept., Associate Editor, Firemen*

BARBARA L. MACKAY, *Librarian*

CHARLES S. MORGAN, *Assistant General Manager*

ROBERT S. MOULTON, *Technical Secretary*

DEUEL RICHARDSON, *Manager, Public Relations Department*

DORIS A. SHELDON, *Supervisor, Publications Service Department*

FRANK STETKA, *Electrical Field Engineer*

RICHARD E. STEVENS, *Assistant Technical Secretary*

GEORGE H. TRYON, III, *Assistant Technical Secretary*

AGNES W. WILSON, *Supervisor, Bookkeeping Department*

REXFORD WILSON, *Engineer, Fire Record Department*

MILES E. WOODWORTH, *Flammable Liquids Field Engineer*

Quarterly

of the

NATIONAL FIRE PROTECTION ASSOCIATION

Copyright 1958, National Fire Protection Association

ROBERT S. MOULTON, *Editor*
GEORGE H. TRYON, III, *Associate Editor*
CHESTER I. BABCOCK, *Fire Record Editor*

MARGUERITE C. CHAFFIN, *Editorial Assistant*
DOROTHY H. ERNST, *Editorial Assistant*
HENRY S. GERE, *Advertising Manager*

Vol. 52 No. 1 **July 1958**

Table of Contents

Richard E. Vernor ..... Frontispiece

A Tribute to Dick Vernor
Percy Bugbee, General Manager, NFPA 5

Basement Sprinklers — Retroactively
Dale F. Gilman, Fire Marshal, City of Portland 6

Meetings of Board of Directors
Chicago, Illinois, May 19, 1958 12
Boston, Massachusetts, June 30, 1958 13

Research Tests with Foam-Water Sprinklers
H. B. Peterson, U. S. Naval Research Laboratory 17

Upgrading Hotel Fire Safety in Winnipeg
E. G. Simpson, Engineer of Inspections, City of Winnipeg 28

Radioactive Filter Design Fire Problems
Don J. Keigher, U. S. Atomic Energy Commission 38

Boston's Blighted Boroughs
Benjamin M. Hermes, New England Fire Insurance Rating Association 45

The Nevada Bomb Test Fire Effects
Kyle P. Laughlin, Federal Civil Defense Administration 53

Identifying Fire Hazards of Materials
J. S. Queener, NFPA Committee on Fire Hazards of Materials 62

Building Code Criticisms Often Misdirected
Horatio Bond, Chief Engineer, NFPA 64

The New York Museum Fire
Rexford Wilson, Engineer, NFPA Fire Record Department 67

Reviews and Abstracts of Technical Papers 77

Index to Advertisers 80

Articles and accounts of fires appearing in the Quarterly are based on material forwarded to the Association. The Association, as a body, does not assume responsibility for the accuracy of the material printed herein.

Indexed by Engineering Index, Inc.

Richard E. Vernor

Died June 3, 1958

A Tribute to Dick Vernor

We can think of no member of NFPA who had the friendship and good will of as many of our members as did Dick Vernor. Dick's enthusiasm for and devotion to NFPA has been demonstrated to all members time after time over the more than thirty years that he has been intensely active in our affairs. Ever since 1930, Dick served continuously as a director or officer of the Association. He was elected Vice-President in 1940, President in 1944, and Chairman of the Board of Directors in 1950. He was elected an Honorary Life Member in 1955.

In very many ways Dick Vernor expressed his pride in his official connection with NFPA. In his regular work as Manager of the Fire Prevention Department of the Western Actuarial Bureau, he was in constant demand as a speaker on fire prevention. In all of his speaking engagements he never failed to ask that he be introduced as an officer of NFPA and never failed to mention and recommend membership in the NFPA.

All of our members know of the tremendous contribution to the fire service that Dick Vernor made as the Director of the Fire Department Instructors Conference (the famous Memphis Conference). At these annual great gatherings, he never failed to promote the NFPA to those in attendance.

In his years of service to Rotary International, he lost no opportunity to tell Rotarians about NFPA. In his years of service as Chairman of the Contest Committee of the Fire Waste Council conducted by the United States Chamber of Commerce, he never missed a chance to recommend NFPA to the local Chambers of Commerce.

A letter from NFPA member Fire Marshal Elwood H. Rutherford of Flint, Michigan, expresses eloquently the reaction of our members to his passing:

> "There will be hundreds of NFPA members for whom the task of continuing a successful NFPA organization will be eased by knowing that Richard E. Vernor has inspired enough of us so that NFPA will grow and grow and we will win the fight to save lives and property from fire."

We of the National Fire Protection Association have all immeasurably been enriched by the loyal and devoted service given so freely over so many years by the late beloved Chairman of our Board of Directors, Dick Vernor.

Percy Bugbee,
General Manager.

Basement Sprinklers — Retroactively

By Dale F. Gilman, Fire Marshal
City of Portland, Oregon

The need for basement sprinklers in commercial and mercantile buildings has long been recognized. How to get them installed in existing buildings has challenged many city fire authorities. Perhaps over a hundred United States and Canadian cities have accomplished the feat. This article tells how Portland, Oregon did it.

Many dramatic fire stories highlight the value and the need for basement sprinklers. Two early case histories tell the story as well as any. In Seattle, Washington on November 12, 1915 an early morning basement fire in the Bon Marché department store was quickly subdued by automatic sprinklers with no loss of life and without excessive damage. In the opposite corner of the country in Manchester, New Hampshire, a basement fire in the Weston and Fitts Building took four lives and caused $250,000 in damages on the morning of May 13, 1917. A Manchester newspaper reporting this fire said:

> "An effort to encourage basement sprinkler protection, through a bill introduced in the New Hampshire Legislature last winter, was not successful as it was thought that to install sprinkler protection would put an undue financial burden on the property owners."

Editorially, the same paper asked:

> "Which is better, to pay a few dollars for sprinklers, or pay in destroyed property, interrupted business, and human life for not having them?"

These incidents and others of more than forty years ago simply remind us that the need for basement automatic sprinkler protection was recognized long before most of us had tasted the searing stuff that makes a hot, subsurface fire so difficult to fight.

I do not know that a full and complete list of effective basement sprinkler ordinances has ever been compiled. I do have a list of nearly one hundred cities and seven states where such regulations have been proposed and, presumably, adopted in one form or another. I wish very much that I could give credit to those cities where this program was really pioneered and where the requirement has been effectively enforced.

One of the outstanding early successes was in the City of Los Angeles where a basement automatic sprinkler ordinance was enacted in 1929. Approximately twenty years later (about 1949) Chief John Alderson had this to say about the result of that ordinance:

> "Basement fires have ceased to occur in Los Angeles. In fact, most of the members of this department have never fought a real fire in a basement. We simply do not have them. I have talked with a number of older men, and the last basement fire of any extent which anyone can remember occurred about nineteen years ago. The cellar pipes, circulating nozzles, and other specialized equipment which we carried for basement fires have either been removed from apparatus or merely gather dust and require occasional polishing."

That statement was made in support of the Portland ordinance at a time when every little scrap of supporting evidence was sorely needed. Now, many other cities can say the same thing. Large loss fires originating in the basements

Based on an address by the author at the 31st Annual Meeting of the Fire Marshals' Section of the NFPA held in conjunction with the 62nd NFPA Annual Meeting, Chicago, Illinois, May 19-23, 1958.

of commercial and industrial buildings are becoming a thing of the past in those cities having basement sprinkler ordinances. Thank goodness hundreds of men in the fire services today will never know what it is like to have a basement fire honeycomb an entire building while they fight desperately to get at the seat of it.

History of Portland Action

It was in November of 1952 that my predecessor as Fire Marshal of Portland, Chief Miles Woodworth, pulled up stakes to become your NFPA Flammable Liquids Field Engineer. This left me with the enforcement of a basement automatic sprinkler ordinance which he had succeeded in getting on the books three years earlier. Chief Woodworth deserves a lot of credit for his leadership to secure the necessary amendment to the Portland fire code. It was on September 11, 1947 that he first succeeded in getting his proposal before the City Council in ordinance form. The introduction of this proposed ordinance was preceded by numerous consultations with the Chief of the Fire Department, the Commissioner of Fire, and with all of the property owner-management groups. Without going into detail on the early history of the action, a substitute ordinance was passed by the Council on July 14, 1949.

On that eventful day in July of 1949 the council chamber was packed with remonstrators who made vigorous appeals for the defeat of this ordinance. Chief Woodworth stood almost alone in the face of this opposition. His statement and recommendation is fully recorded in proceedings of the City Council. He recited many instances of extreme difficulty in fighting basement fires, the physical effect on firefighters, and the terrific loss that invariably resulted. In defense of his ordinance he used Portland statistics, statistics which conclusively proved that three per cent of our fires originated in basements and accounted for more than 25 per cent of the total loss for a given period. The actual loss attributable to basement fires during the preceding ten-year period had been $3,076,478.92. Truly, without Chief Woodworth's aggressiveness back there in the 1940's, I doubt that Portland would yet have the law which is now known as Section 14-530 of the Portland Fire Code*.

The ordinance did not require compliance for a period of five years, except that, as an exercise of police power and for the public safety, the Fire Marshal was given the authority to order and direct the installation of a basement sprinkler system at any time prior to the expiration of the said five years in any particular premises where an unusual hazard was known to exist. This five-year period gave time in which to study the problem and to prepare a plan. The possibility of a contested order and an adverse court ruling had to be considered. The City Attorney advised that a validity attack could be expected on the least provocation. Any number of cagey and well-prepared property owners were just waiting for the Fire Department to make an indiscreet or a legally improper move.

First: A Survey of All Property

The first move was to survey every property in the fire districts to which the ordinance applied and to set up a working file of such properties. The information obtained on each included a legal description of the property; the ownership; the height of the building and the type of construction; the ground area covered and the area of the basement proper; the basement height (or depth) measured from the floor of the basement to the joists, the ceiling or the floor above; and an average measurement of the height to which the basement extended above established grades.

All of this information had to be assembled before we could safely enforce the ordinance because of the exceptions which had been included. These ex-

*This Section of the Portland Fire Code is reproduced on pages 10 and 11.

ceptions, eight in number, necessitated many borderline decisions. One exception excluded habitational buildings which could be legally occupied by as many as four families. A building having a basement area of less than 1,000 square feet and containing no combustible material of any kind was excluded. The terms "grade" and "basement area" were defined; any basement having one-third but not less than three feet of its average height *above* grade, and having at least two means of access by windows or doors, was excluded.

Also excluded was that portion of the basement area of a building of fire-resistive construction which would not be used for the storage of combustibles. But who was to say that this portion, or that portion, of a particular basement was not to be so used? The Fire Department assumed that the entire basement had to be sprinklered until the owner submitted a specific request for an exemption together with a written statement relative to the use of the space with a drawing of the entire basement which could be marked accordingly and filed. Today, when the Fire Department agrees to the requested exemption, the owner is so informed by letter with the definite understanding that extended sprinkler coverage will be required if at any time in the future the unprotected areas are used for combustible storage purposes.

Dealing with the Property Owners

A vast majority of property owners are cooperative. None, of course, could be blamed for objecting to an expenditure of money without good reason. When we sent our first notices to owners of the affected properties in February and March of 1953 with a copy of the ordinance enclosed, we carefully avoided writing general broad orders for compliance but instead wrote selective orders applying to each property on which we had complete information. This kept the danger of any potential organized opposition down until the program was better than 75 per cent completed. When the people who were prepared to attack rallied to do so, it was too late. Slowly, but surely, the objectors complied and today, with 573 basement sprinkler installations accounted for, the program is about 96 per cent complete.

New Fire Limits Extend Coverage

However, we are now faced with the necessity of starting all over again. When our new Portland Building Code was adopted in July of 1956, the first and second fire limits, to which the retroactive basement sprinkler requirements of the fire code apply, were substantially increased in area. This had been anticipated. Section 14-530 of the fire code provides that the retroactive basement sprinkler requirement would apply to the first and second districts *as from time to time defined* in the building code. In all probability, Portland will have a new fire marshal before it can again be said that our program is 96 per cent complete.

On the subject of the relationship between Fire and Building Codes, I am reminded of a legislative opposite of this retroactive requirement. The new Portland Building Code called for broader automatic sprinkler protection than ever before, including basements in new construction wherever located. Yet when this code was before the City Council for adoption in 1956, not one single voice was heard in opposition to this fire protection requirement. This shows that a costly code provision can be projected into the future with much less difficulty than when the same is to be applied retroactively.

Handling Appeals and Issuing Permits

Another item of interest has to do with handling appeals from orders of the Fire Marshal to comply with this basement automatic sprinkler requirement. Our Fire Code Board of Appeal is composed of three regular members and three alternates, all appointed by the Mayor for terms of three years. One each of the regular and alternate mem-

bers represents property interests. Both of these men went on record in opposition to the ordinance in 1949. Both have since taken appellants to task during hearings for failure to appear on the side of the opposition at that time. The usual question is: "Where were you in 1949?" Yet, the Appeal Board, with these men sitting in judgment, has granted complete relief from basement automatic sprinkler orders in only one case, and these men are well aware of the fact that the aggregate cost in Portland to date, without projecting it into the future, has been about $1,250,000, or an average of $2,500 per basement.

The mechanics of enforcement should include a permit requirement. Every installer of a sprinkler system should be required to submit plans for examination before the permit is issued. In Portland the permit requirement was written into the Plumbing Code. It provides that the Fire Marshal should first examine and approve the drawings and should make the final inspection and issue a certificate of satisfaction upon completion.

Advice to Others

Any community where a basement problem occurs should have a basement automatic sprinkler law. Any such law, once enacted, should be diligently enforced. The ordinance should provide for reasonable exceptions, carefully worded, to be sure that the intent cannot be broadly or unreasonably interpreted. Terms and definitions should be clear, and contained within the ordinance proper. It is dangerous, for example, to refer to another document or code for definitions of such terms as "grade" and "basement area." Portland nearly got into serious trouble because our ordinance at first referred to the Building Code for such definitions. This situation was hastily corrected when it was discovered that definitions thus adopted by reference would exclude many basements where the installation of sprinklers had been intended.

On the other hand, it seems quite desirable to adopt standards of installation by reference. It is in this way that the Portland ordinance references the NFPA Standard for the Installation of Sprinkler Systems (No. 13) and provides for only two exceptions; specifically: that the water service connection may be two inches in diameter (inside pipe size) if the basement is 10,000 square feet or less within foundation lines; and that only a single pumper connection need be provided if the basement area is less than 5,000 square feet in area.

While I am talking about a standard of basement sprinkler installation, I would like to give you an idea which is not at all original, but has some merit in a pinch. No one would advocate sprinklers without provisions for an adequate water supply, but every one of us in the firefighting profession has seen the time when a basement dry pipe system conforming in all respects with NFPA No. 13 but having nothing more in the way of water supply than the usual pumper connections, would have been a blessing.

Notice to All Readers

The NFPA would like to assemble a current record of all cities having basement sprinkler ordinances. If your city has one would you advise the Editor of the QUARTERLY and forward a copy of the Ordinance in effect? We would appreciate your cooperation.

Excerpt from Portland Fire Code

Basement Sprinkler Ordinance

Section 14-530. Automatic Fire Extinguishers in Certain Basement Areas.

In the first and second Fire Districts as defined from time to time in the Building Code (Ordinance No. 103415), it shall be unlawful for any owner or person having the control or use of any building which now or in the future has a basement area not exempt under this section, to continue such basement area, whether in use or not, without complying with this section. The term "basement area" as used in this section shall, unless otherwise indicated, mean a story, any portion of which is below the grade of the building, or a cellar or sub-cellar. "Grade" of a building shall mean, for buildings adjoining one street only, the elevation of the sidewalk at the center of the wall adjoining the street; for buildings adjoining more than one street, the average of the elevations of the sidewalk at the center of all walls adjoining a street; for buildings having no wall adjoining a street, the average level of the finished surface of the ground adjacent to the exterior walls of the building, but walls approximately parallel to and five feet or less from a street line are to be considered to adjoin the street. The height of a basement shall be measured from the floor surface to the bottom of the floor joists above or the surface of the ceiling above.

(a) Except as provided in subdivision (c) hereof an automatic sprinkler system meeting the requirements of this section shall be installed and thereafter maintained in such basement area.

(b) If the basement area of such building has more than 10,000 square feet in area within the foundation lines, said system shall be in compliance with the regulations contained in the National Board of Fire Underwriters' Pamphlet No. 13*, entitled: "Standards of the National Board of Fire Underwriters for the Installation of Sprinkler Systems," dated August, 1955, a copy of which pamphlet shall be filed in the office of the Auditor and as filed made a part of this ordinance.

(c) If such building has 10,000 square feet or less in basement area within the foundation lines, said sprinkler system shall be as provided above in subdivision (b), except that the following deviations are allowed: (1) the water service connection for said sprinkler system may be two inches in diameter IPS (Iron Pipe Size); (2) if the basement area is less than 5,000 square feet, said system shall have one or more 2½-inch pumper connections placed on the street front of the building in an unobstructed position at least one foot and not more than four feet above the sidewalk grade, such pumper connection to be for use by firefighting apparatus in order to increase the water pressure in the sprinkler system and to be connected with the sprinkler system as directly as possible by means of one 2½-inch IPS; and (3) if the basement area be more than 5,000 square feet but less than 10,000 square feet within foundation lines said system shall have at least one 2½-inch 2-way siamese pumper connection placed as provided in the above paragraph and connected as directly as possible to the main sprinkler system supply by means of a 4-inch IPS.

(d) The materials used in said system, the coverage thereby and the sprinkler head spacing shall be provided in Exhibit "A"*. If in any such basement area there are one or more floor drains, said drains shall be clearly marked by placing on the ceiling immediately above the same the word "DRAIN" in letters six inches in height and having a stroke one inch in width, and a color sharply contrasting with the background.

(e) The basement areas exempt from the provisions of this section are:

1. A single-family dwelling.
2. A two-family dwelling.
3. A three-family flat or apartment building.
4. A four-family flat or apartment building.

*As recommended by the National Fire Protection Association.

*NBFU Pamphlet No. 13 is reproduced in the Portland Fire Code as Exhibit "A".

5. A building having a basement area of less than 1,000 square feet and containing no combustible material of any kind.

6. Basement area of a multiple dwelling where the building immediately above the basement area houses not more than four families.

7. That portion of any basement occupied for dwelling purposes in conformity with code requirements; and also any basement which meets all of the following requirements: at least one-third of its average height is above the grade of the building, at least three feet of its average height is above the grade of the building, there are at least two means of access by exterior windows or doors, and each window counted provides an opening not less than 22 inches high and 30 inches wide, above the grade of the building and above the adjacent ground surface. This exemption shall not apply to basements of hospitals or places of refuge.

8. That portion of any basement area of a building of Class 1, 2, or 3 construction which is not used for storage of combustible goods to the extent that such area would constitute a fire hazard, or for retail purposes, and which portion is divided from the remainder of the basement area by a noncombustible constructed wall. Also that portion of a basement area where sprinklers are undesirable because of the nature of the contents.

(f) All premises coming within the application of this section shall be so equipped within a period of not to exceed five (5) years from the *effective date of this ordinance*,* provided, however, that as an exercise of the police power and for the public safety the Fire Marshal shall have authority to order and direct the installation of a sprinkler system as herein defined at any time prior to the expiration of the said five (5) years in any particular premises, and provided further, that the owner, agent or other person having control of any premises in which the installation of a sprinkler system is ordered by the Fire Marshal prior to the expiration of the five (5) year period shall have the right of appeal to the Council. The order of the Fire Marshal for the installation of a sprinkler system shall be in writing. Appeal from the order shall be in writing and shall be filed with the Council of the City of Portland within ten (10) days of the date of the Fire Marshal's order.

*August 14, 1949.

Meetings of Board of Directors

Chicago, Illinois, May 19, 1958

Present

John A. Neale, President
Henry G. Thomas, Vice-President
Loren S. Bush, Vice-President
A. L. Cobb, Past President
T. Seddon Duke, Past President

Dale K. Auck	A. Leslie Ham
Warren J. Baker	Clarence W. Higbee
Malcolm S. Blake	J. S. Queener
Charles H. Bunn, Jr.	Elmer F. Reske
Marshall B. Dalton	George J. Richardson

Percy Bugbee, General Manager; Robert S. Moulton, Technical Secretary.

President John A. Neale presided in the absence of Chairman Vernor.

Business Transacted

1. The report of the Chairman to the annual meeting was read and approved. It was agreed that this should be presented by Vice-President Thomas.

2. Treasurer Freeman's report was reviewed and approved for presentation to the annual meeting by Assistant Treasurer Bugbee.

3. In the absence of requests for special Board action from committees, no action was taken on this item.

4. Plans for the 1958 fall meeting at the Penn Sheraton Hotel, Pittsburgh, November 17–19, were approved, also tentative plans for the 1959 fall meeting at the Hotel Fort Des Moines, Iowa, November 11–13, 1959.

5. Distinguished Service Awards to be presented to members R. D. MacDaniel, Harold Muir, A. J. Steiner, and David Stroop were approved.

6. After consideration of a request from an advertiser desiring the use of the outside back cover of the QUARTERLY, it was voted to make no change in the present policy which provides for the continued use of this space by the original advertiser.

Committee Reports

7. Chairman Cobb reported for the Industrial Committee stating that the Guide for Management of Fire Emergencies published in the 1958 Advance Reports, page 512, was to be offered as a progress report and to be subsequently published for a limited circulation in order to secure additional comments and criticisms prior to offering in revised form at the 1959 annual meeting. This proposal was approved by the Board.

8. Mr. Bugbee reported on the joint committee of the International Association of Electrical Inspectors and the NFPA concerning the administration of the IAEI office. He stated that Mr. Frank Stetka, recently appointed NFPA Electrical Field Engineer, was functioning in a separate office in Chicago as NFPA Electrical Field Engineer and Code consultant to the IAEI, but without executive responsibilities for the IAEI. Mr. Bugbee indicated that the arrangement seemed satisfactory to all concerned.

9. Mr. Bugbee reported on the Sponsors Committee, soliciting suggestions from Board members as to the selection of a new chairman.

10. Mr. Bugbee reported the retirement of Mr. Leonard Peterson and his resignation from the Board, indicating the need for filling this vacancy by the Board at its next meeting.

11. Messrs. Blake, Cobb and Reske, retiring Board members, expressed their appreciation for the privilege of serving on the Board and their thanks for the many benefits received.

12. Messrs. Queener and Duke commended the NFPA article on rocketry published in Fire News, expressing concern about the hazard of amateur experi-

ments and the hope that NFPA would continue its activities in this field.

13. It was voted to hold the next meeting of the Board in Boston on June 30.

Boston, Mass., June 30, 1958

Present

Henry G. Thomas, President
Loren S. Bush, Vice-President
J. Sharp Queener, Vice-President
T. Seddon Duke, Past President
John A. Neale, Past President
Hovey T. Freeman, Secretary-Treasurer

Dale K. Auck
Warren J. Baker
W. H. Forristall
Clarence W. Higbee
Paul C. Lamb
Jerome Lederer
John H. Redmond
Leigh R. Sanford
Udell C. Young

Merwin Brandon, Chairman, Electrical Section
Roger H. Wingate, former Board member

Percy Bugbee, General Manager; Robert S. Moulton, Technical Secretary; Horatio Bond, Chief Engineer; Charles S. Morgan, Assistant General Manager; George H. Tryon, Assistant Technical Secretary.

Business Transacted

1. Resolutions were adopted relative to the death of Board Chairman, Richard E. Vernor, and Honorary Member Harry E. Newell. The General Manager was requested to record these resolutions and to transmit them to Mrs. Vernor and to Mrs. Newell.

2. Mr. T. Seddon Duke was elected as Chairman of the Board to fill the vacancy due to the death of Chairman Vernor.

3. The following officers of the Corporation were elected in accordance with the vote of the annual meeting: President — Henry G. Thomas, Vice-President — Loren S. Bush, Vice-President — J. Sharp Queener, Secretary-Treasurer — Hovey T. Freeman.

4. The resignation of Director Leonard Peterson was accepted with regret and best wishes for his future health and happiness. Mr. W. H. Berry, Vice-President of the America Fore Insurance Group, New York, was elected in Mr. Peterson's place to serve until the 1960 annual meeting.

5. Mr. W. H. Forristall and Mr. Paul Lamb were elected to the Nominating Committee for 1959. (Other members of the Nominating Committee previously selected include Hugh V. Keepers, Dallas, Chairman; T. Seddon Duke, Philadelphia; C. S. Mullen, Jr., Richmond; John A. Neale, New York; H. W. Ponton, Stevens Point, Wis.)

6. The holding of the 63rd annual meeting in the Dennis Shelburne Hotels, Atlantic City, June 1–5, 1959 was confirmed. Tentative approval was given to the following meetings: Montreal — May 16–20, 1960; Detroit — May 15–19, 1961; Philadelphia — May 14–18, 1962; San Francisco — May 20–24, 1963. The General Manager was requested to investigate the possibilities of holding our 1964 annual meeting in Dallas, Texas.

7. The Program Committee for the 1959 annual meeting was selected as follows: the President, the Chairman of the Board of Directors, and the General Manager.

8. Mr. Morgan reported on the Fall Conference scheduled for Hotel Penn Sheraton, Pittsburgh, Pa., November 17–19, 1958, and reported that Mr. W. K. Estep has accepted the chairmanship of the Sponsoring Committee. These arrangements were confirmed by the Board. Various Board members indicated their intention to be present at the Pittsburgh Conference.

9. The report of Treasurer Hovey T. Freeman was adopted.

10. The budget for 1958–59 as prepared by the staff and submitted by the General Manager to the Finance Committee was amended and adopted.

11. Mr. Bugbee reported on developments in the Field Service Sponsors Committee and requested suggestions from members of the Board.

Committee Reports

12(a). Mr. Brandon reported for the Electrical Section indicating appointment of Mr. Frank Stetka as Electrical Field Engineer, his installation in the Chicago office of the NFPA, and the fact that he serves the NFPA and acts as Code consultant for the International Association of Electrical Inspectors, but has no administrative responsibility for the IAEI. Mr. Brandon also reported on various developments in connection with the National Electrical Code, mentioning the nontamperable fuse situation and various other developments which might subsequently result in controversy. This report was accepted.

(b) Mr. Moulton read a letter from Mr. C. H. Bunn, Jr., Chairman of the Flammable Liquids Field Service Committee reporting satisfaction with the activities of our Flammable Liquids Field Engineer, Mr. Miles Woodworth, and indicating that this project, though not yet adequately financed, is operating on a satisfactory basis. He referred to the death of Mr. Harry E. Newell, Honorary Chairman of the Flammable Liquids Committee, and Mr. George Clough, representative of the Fire Marshals' Section, who served as Chairman of the Sectional Committee on Transportation of Flammable Liquids. He also referred to various new projects in the committee. He suggested that consideration be given to discontinuing the Sectional Committee on Classification, Labeling and Properties of Flammable Liquids as its functions have now been assumed by the Committee on Fire Hazards of Materials. This suggestion was referred to the Technical Advisory Committee. His report was approved.

(c) Mr. Moulton spoke for the Gases Field Service Project indicating general satisfaction with the activities of Mr. Clark Jones, Gases Field Engineer, and reporting that this project, while still in the black, would require additional financing in the near future in order to keep it on a proper basis. This report was accepted.

(d) Mr. Warren Baker, Vice-President of the Society of Fire Protection Engineers, reported on the satisfactory progress in the Society and indicated that there was a small financial surplus in current operations of the Society. This report was accepted.

(e) Mr. Morgan reported on the Fire Marshals' Section indicating that this section was conducted as part of the regular NFPA operations and had no separate budget. There was general discussion of the activities of this section, its representation on committees, and satisfaction with its activities.

13. Standard No. 192A on Volunteer Fire Department Apparatus and Equipment, referred to the Board by action of the annual meeting, was adopted in the name of the Association on recommendation of the Committee on Fire Department Equipment. No. 193 on Fire Department Ladders, Ground and Aerial, Use, Maintenance and Testing, was adopted on recommendation of the Committee on Fire Department Equipment. This standard was presented to the annual meeting but subsequent editorial changes required Board action.

14. Mr. Roger Wingate presented to the Board the suggestion of Mr. O. E. Ringquist, President of the Federation of Mutual Fire Insurance Companies, that the NFPA consider the establishment of a Committee on Windstorm Damage. This was discussed and referred to the Technical Advisory Committee for further consideration and report to the Board at its next meeting.

15. The Committee on Visual Education, of which Mr. Richard E. Vernor had been Chairman, was discharged.

16. A communication from Mr. A. C. Hutson relative to the Committee on Signaling Systems and Thermostats was received. A communication from Mr. Edward A. Brass on the same subject was withdrawn by Mr. Brass.

Technical Advisory Committee Report

17. The report of the Technical Advisory Committee was presented by Chairman T. Seddon Duke and action taken as follows:

(a) The title of the Committee on Firemen's Training was changed to "Fire Service Training."

(b) The Committee on Signaling Systems and Thermostats was authorized to change the designation of its Sectional Committee on "Pamphlets 71 and 72" to "Sectional Committee on Private Fire Alarm Systems."

(c) The request of the Committee on Signaling Systems and Thermostats to omit the names of committee members from the final publication of Standard No. 74, Automatic Fire Alarm Systems for Private Dwellings, was rejected.

(d) The Committee on Civil Fire Defense was placed in an inactive status but it was voted that the names of the committee personnel be continued in the NFPA Year Book.

(e) A new Committee on Cutting and Welding Practices was created to cover both gas and electric welding and to provide guidance to the operators of equipment.

(f) It was agreed that while preference should be given to the preparation of reports in the form of standards, there are certain items which properly belong in ordinance form and that the Committee on Laws and Ordinances should be continued for the purpose of passing on such matters. It was agreed that it was the proper function of this committee to determine the appropriateness of subjects for proper treatment in ordinance form.

(g) It was reported that the Technical Advisory Committee has under consideration the nomenclature of the titles of standards with the idea of providing guidance to committees in the use of the words "codes," "standards," "recommended practices," etc., but that certain differences in various segments of our membership relative to the meaning of the word "should" require clarification before any final action is taken on this subject.

(h) It was reported that the Committee on Signaling Systems and Thermostats is making satisfactory progress relative to gas-operated fire alarm systems and that the Committee on Fire Hazards of Materials is likewise making satisfactory progress in respect to matters referred to it by the Board at the January meeting.

18. The list of committee appointments presented to the Board on recommendation of the Technical Advisory Committee was approved, also a supplementary list which was read at the meeting. The Technical Advisory Committee was given authority to act on other pending matters of committee personnel prior to the next printing of the NFPA Year Book, subject to confirmation by the Board at its next meeting. All existing committee members were reappointed except those who have resigned.

19. The Technical Advisory Committee for 1958–59 was appointed as follows: T. S. Duke, Chairman, A. L. Brown, Hylton R. Brown, John A. Neale, Henry G. Thomas.

Misuse of NFPA Name

20. Mr. Bugbee reported on recent incidents in which persons selling fire protection equipment had misused the name of the NFPA and the NFPA membership certificate and raised the question as to whether such persons should be dropped from NFPA membership. After discussion, it was voted to request Mr. Bugbee to secure an opinion from the Association's legal counsel relative to the best procedures to be followed in such matters and to report this opinion to the Board.

21. It was voted to hold the next meeting of the Board on Thursday, January 22, 1959, at the Union League Club in New York.

22. A communication from Mr. John Morris of the South-Eastern Underwriters Association relative to the manner of operation of the Flammable Liquids Committee was referred to the Technical Advisory Committee.

23. A communication from Board member Dale Auck was acted upon as follows:

(a) Mr. Auck's suggestion that there should be a formal banquet at every annual meeting was referred to the Program Committee.

(b) His suggestions concerning Distinguished Service Awards were discussed without action.

(c) The suggestion concerning the date and method of handling of the NFPA Fire Prevention Contest was referred to the Committee on Fire Prevention and Clean-up Campaign.

(d) His suggestion concerning the limitation of the term of the Chairman of the Board was discussed without action.

24. A communication from Lieut. H. Saveci of the Turkish Navy was read by Mr. Bugbee and received with expressions of commendation to Lieut. Saveci for his energy and enthusiasm for fire prevention.

Research Tests with Foam-Water Sprinklers

By H. B. Peterson, Head

Fire Engineering Section, Engineering Chemistry Branch

U. S. Naval Research Laboratory

Aircraft carrier hangar decks present the United States Navy with one of its greatest potential "hot spots." As many as 80 planes, all with wings folded to the overhead, may be crammed into this 80 by 800 foot space. The cost of one of the newest Navy planes for carrier operation approaches the $9,000,000 mark. In order to protect this investment, the Damage Control Branch of the Bureau of Ships must make every effort to keep pace by providing the most modern fire-fighting weapons.

The present fire protection scheme for the hangar deck space of carriers consists of two systems, a high capacity fog-foam system and a water sprinkler system. The fog-foam system was devised and installed in carriers at the end of World War II. It consists of a number of individual foam concentrate storage tanks and proportioners spaced throughout the length of the ship. Each station holds a 300-gallon foam concentrate supply and is capable of proportioning up to 1,000 gallons per minute of six per cent foam solution through a riser to the hangar and flight decks. A feature of its design is that it depends only on pressure in the fire mains to be fully operative. Foam is produced and delivered by aspirating handline nozzles or from a fixed monitor on the hangar deck.*

Essentially the fire hazard is from aviation fuels and for this reason the development of the combination foam-water sprinkler has been studied with considerable interest as offering a means of improved protection. This device is installed in the manner of the conventional water sprinkler and is designed to produce a foam spray discharge when supplied with a six per cent foam solution. In the event the supply of foam concentrate fails or becomes exhausted, the water discharge pattern approximates that of a conventional water sprinkler.

Test Program

In order to obtain some basic information on the action and mechanisms of a foam-water sprinkler system under hangar deck conditions, an arrangement was made to conduct full-scale fire tests at the Underwriters' Laboratories new facility in Northbrook, Illinois. The fire tests were planned to study the relative actions of the following three agents:

1. foam from foam-water sprinkler,
2. coarse particle water spray from the same sprinkler and
3. fine particle water spray from a pendent water sprinkler.

In addition to the basic differences between the three agents there are, of course, the additional variables:

1. operating pressure,
2. foam quality,
3. application rate, and
4. height of sprinkler above deck.

The comparison of the agents and their variables was based on the following four factors:

Based on a paper presented by the author at the 62d NFPA Annual Meeting held in Chicago, Illinois, May 19-23, 1958.

*See pages 56-61 of the July 1951 QUARTERLY of the NFPA for additional details on the present fog-foam equipment aboard U. S. Navy aircraft carriers.

Tests conducted at Underwriters' Laboratories, Northbrook, Illinois for the U. S. Navy on foam-water sprinklers involved large fires such as shown here during the preburn period. Ceiling temperatures of 1,500° F. were sought before actuation of the sprinklers.

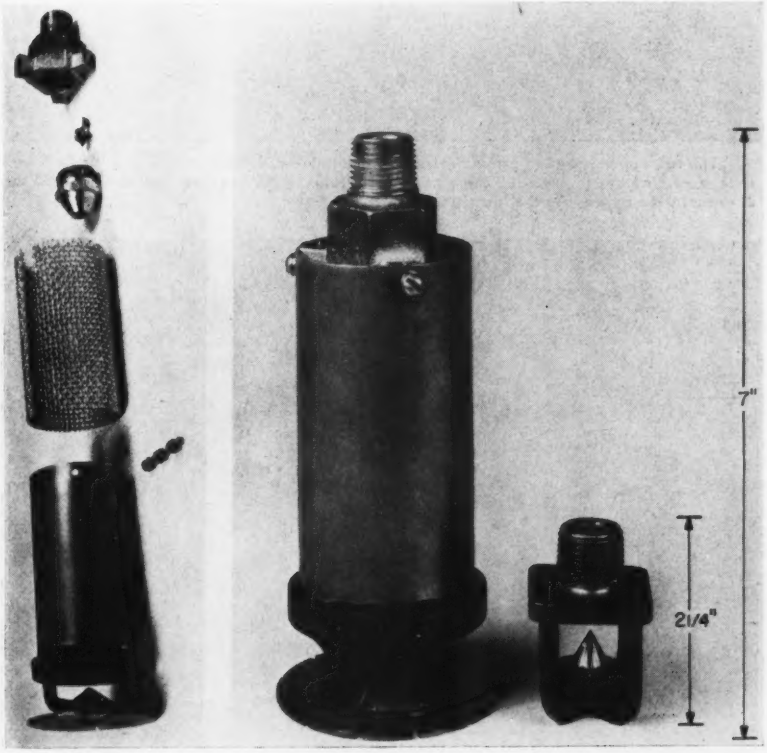
1. fire control and extinguishment,
2. cooling of overhead structural steel,
3. cooling of the air space, and
4. cooling of objects within the fire area.

JP-4 was used as the fuel in all fires. It is a hydrocarbon mixture similar in fire hazard characteristics* to gasoline and has a flash point as low as minus 40°F. Three steel pans totaling 349 square feet in area held the fuel.

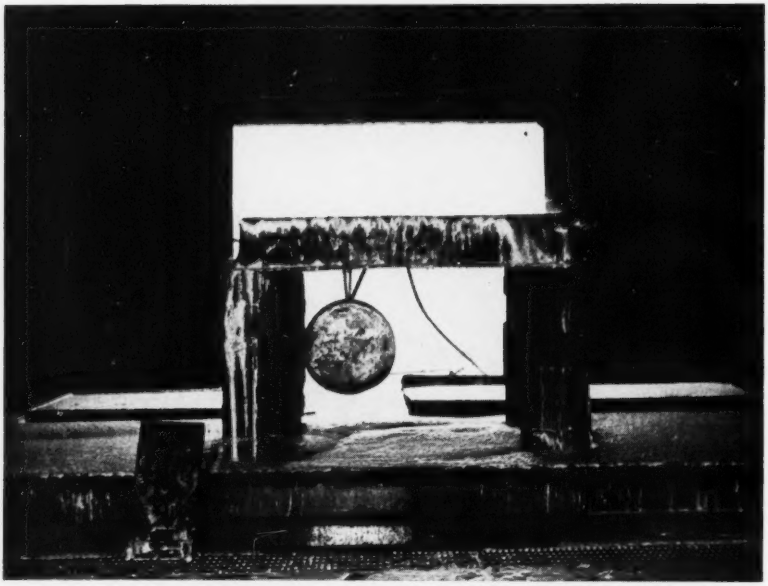
Thirty-two thermocouple junctions were distributed throughout the test space to record air temperatures and temperatures of the overhead unprotected structural steel "I"-beams.

As a means of observing the effect of obstructions such as aircraft wings, a steel surface was placed over a portion of the fuel area. It had a thermocouple junction imbedded in the metal to record the skin temperature changes during the test. Beneath this simulated wing structure was suspended a tank, also fitted with a skin thermocouple junc-

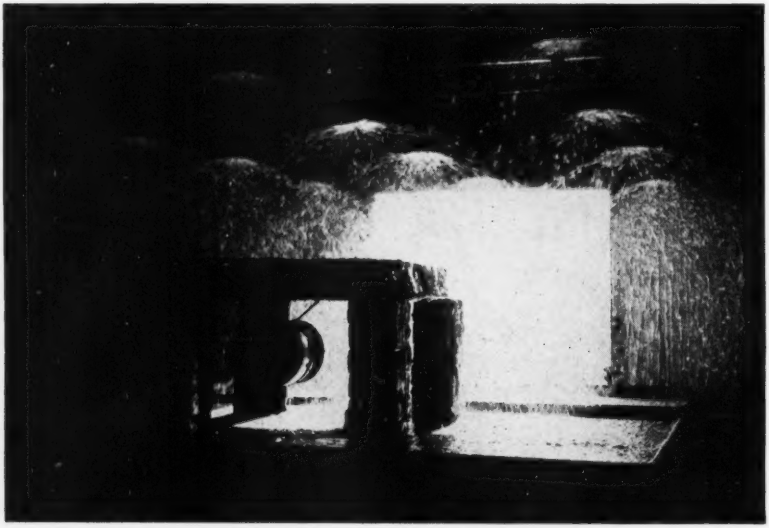
*For further information on the fire hazard properties of this fuel, see NFPA No. 413M, published in pamphlet form (50 cents) and in National Fire Codes, Volume VI.



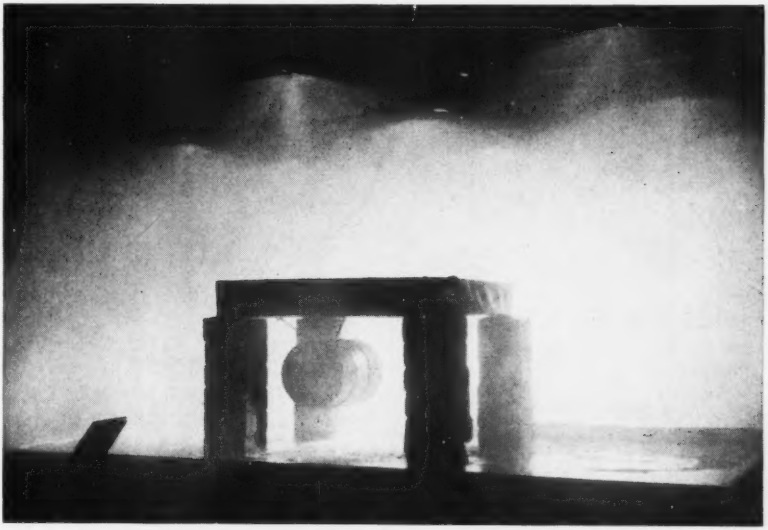
The two different types of sprinklers used. At far right is the water spray head; next is the assembled foam-water sprinkler and, at left, an exploded view of the foam-water sprinkler showing (top to bottom) the swirler, nozzle tip, barrel screen liner and mixing barrel with deflector.



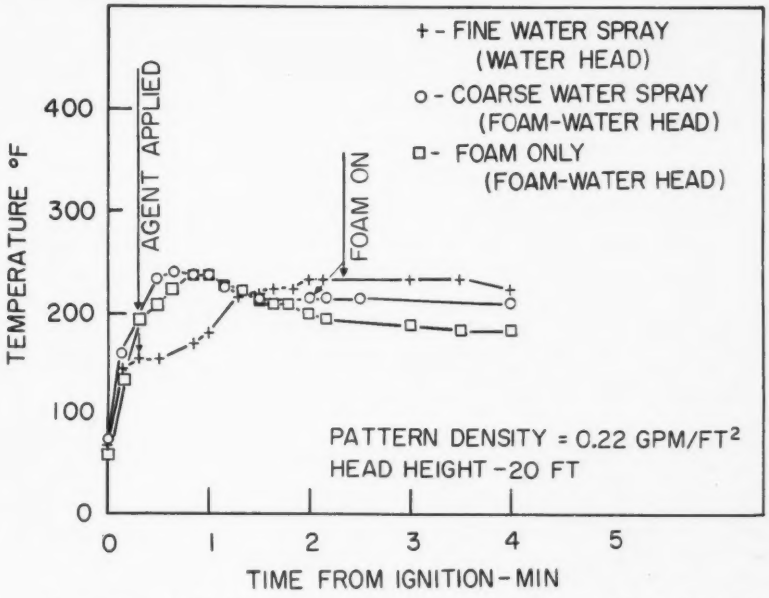
The test space included arrangements for a simulated wing structure and "belly" tank over a part of the fuel area. Three steel pans totaling 349 square feet in area held the JP-4 fuel used to produce the fire situations.



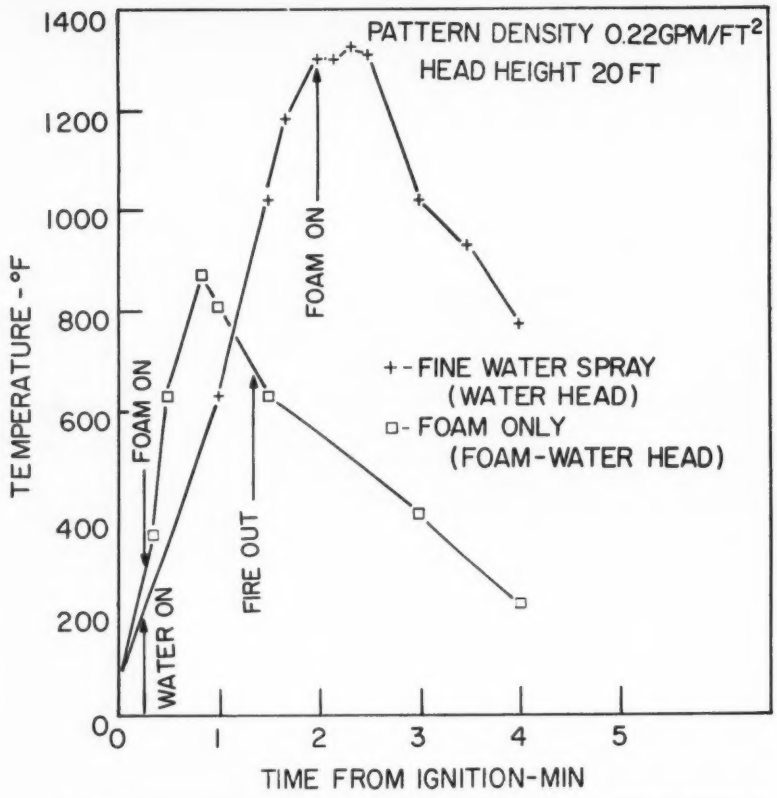
The foam-water sprinklers operating from a height of 20 feet produced this type of foam spray pattern. Note that the foam descends through the air space in widely separated "plops."



View of fine particle water spray as discharged from the water spray sprinkler operating from a height of 10 feet. Eighty per cent of this spray evaporated in the thermal updraft under the fire test conditions described.



Temperature data indicates that cooling action on *top surfaces of the simulated wing obstruction* was practically the same for all agents tested at common densities and sprinkler heights. Foam was required to extinguish the fire when water only was used.



A different temperature curve results *at the simulated belly tank mounted beneath the "wing."* Note the time lag in the effect of agent application. With water spray only, no temperature reduction resulted (until the foam was applied to save the building) whereas the foam from the foam-water sprinkler checked the temperature rise in less than a minute.

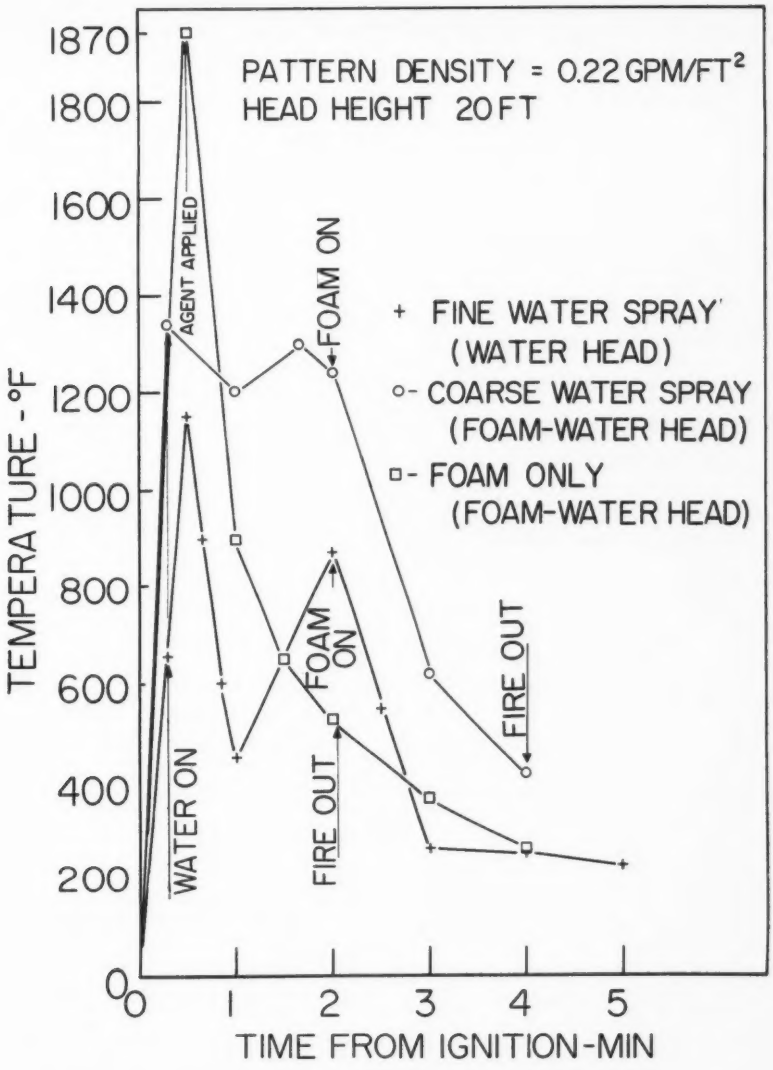
tion, to represent a "belly" fuel tank or other external structures which are "shadowed" and cannot be contacted directly by the discharge of agent from the ceiling sprinklers. Along with these temperature measurements, special foam sampling and water collection techniques provided data on what happened to the water content of the foam.

Summary of Results

1. The results of foam analyses, conducted in accordance with NFPA Standard No. 11* indicated that no significant variations in foam characteristics could be produced by varying the operating pressure. This is generally true for foam devices of the aspirating type.

2. The foam in these tests was characterized by an expansion of 4.5 and a drainage time of 0.7 minutes. No other foam makers of different characteristics were available and thus it was not possible to make any determination of the optimum foam properties. Other work indicates that a foam of higher expansion and higher drainage time would perform better in this type application.

*NFPA Standard for Foam Extinguishing Systems, available in pamphlet form (50 cents) and published in National Fire Codes, Volume IV.



In the air space 5 inches below the sprinklers, foam accomplished an immediate and sustained temperature drop and extinguished the fire in about 2 minutes. The coarse water spray application checked the temperature rise at about 1,300° F. and held it at about that level. The fine water spray caused an immediate drop but could not maintain the reduction. Foam had to be introduced to accomplish control and extinguishment where either coarse or fine water spray was initially used.

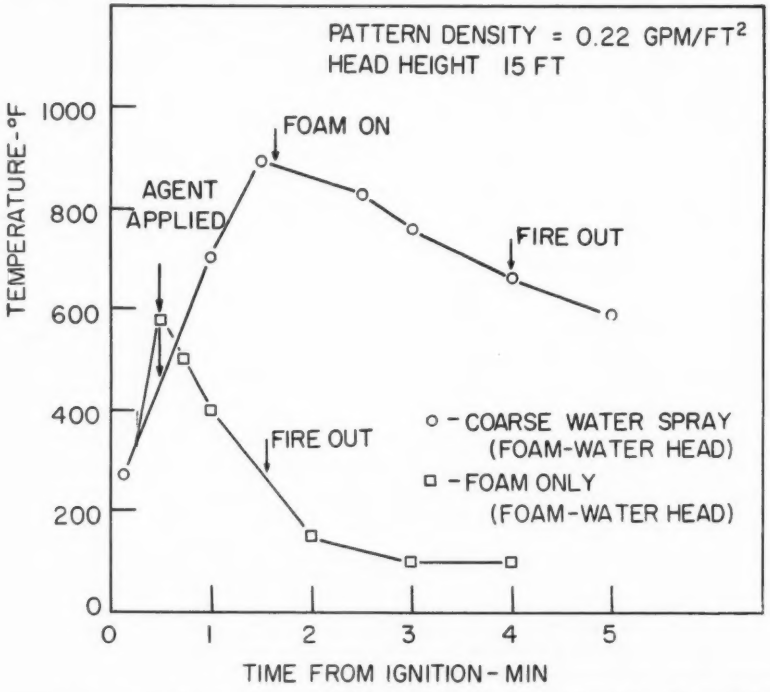
3. Extinguishing times for the foam used averaged 110 seconds when applied from a height of 20 feet and with a water application density rate of 0.22 gallons per minute per square foot of deck (floor) area. (In this discussion, where water is referred to with regard to the use of foam it includes the six per cent foam solution.)

4. Lowering the height of the sprinklers or increasing the density of the water discharge, of course, decreased the extinguishing time. With the sprinklers mounted 20 feet from the deck (floor), an application rate of 0.10 gallons per minute per square foot could not quite extinguish the fire, whereas a rate of 0.16 did extinguish. Therefore, the minimum critical rate of application was judged to be about 0.12 gallons per minute per square foot at this height.

5. Fire tests with and without the obstructions showed no difference in the extinguishing time secured with the foam-water sprinklers which indicated that the foam had good flowing and sealing properties.

6. No extinguishment or control could be obtained through the use of coarse or fine water sprays. It was necessary to apply foam through the foam-water sprinklers in each case to secure extinguishment and save the test building.

7. With a preburn period designed so that ceiling temperatures would reach 1,500°F. before actuation of the extinguishing systems, water or foam which fell directly on top of the simulated



Foam was also superior in achieving temperature reduction *at the thermocouples mounted on the overhead structural steel* by virtue of its control over the deck (floor) fire. Again water spray alone could not accomplish its designed purpose.

wing obstruction suppressed the metal temperatures to about the boiling point of water (212°F.). This indicated that with a water application density of 0.22 gallons per minute per square foot, the water droplets and the foam particles survived the 20-foot drop through the thermal updrafts and heat created by the fires.

9. An appreciable time lag occurred in cooling the simulated "belly" tank beneath the simulated wing obstruction when the foam-water sprinklers were used. The foam, however, was able to check the temperature rise and provide cooling within 20 seconds of initial application by virtue of its extinguishing effectiveness on the spill fire on the deck (floor). With water spray, no temperature suppression was recorded by the thermocouples at this "belly" tank and the temperature continued to rise unchecked until the foam-water sprinklers were actuated to save the building.

10. In the air space, at a point five inches below the overhead discharge devices, cooling was secured when foam was applied to the fire and this temperature reduction was sustained. Coarse water spray checked the rise and held the temperature to a constant level of 1,300°F. until the foam-water sprinklers were actuated to extinguish the fire and save the building. Fine particle water spray caused an immediate temperature drop in this air space but could not maintain the reduction and the temperature was well on the rise again when the switch was made to foam.

11. As to the temperature effects on the overhead structural steel I-beams, the use of the foam water sprinklers resulted in an immediate cooling effect. On the other hand, coarse water spray had no effect on the rate of temperature rise recorded at this same location. Here again, foam cooling was obviously by the indirect action of the effectiveness of the agent on the deck (floor) fire.

12. Calculations of the burning rate of the JP-4 fuel show a heat generation rate of 5,000 Btu's per minute per square foot. The heat absorbing capacity of the water application at a density of 0.22 gallons per minute per square foot is approximately 2,000 Btu's per minute per square foot. These two values show that an unfavorable situation exists when an attempt is made to have water penetrate the thermal updrafts and the hot combustion gases in the air space to reach the burning fuel surface. Thus it can be realized that the heat absorption capabilities and the mass of the agents become very important, especially as the height of the sprinkler above the deck (floor) increases.

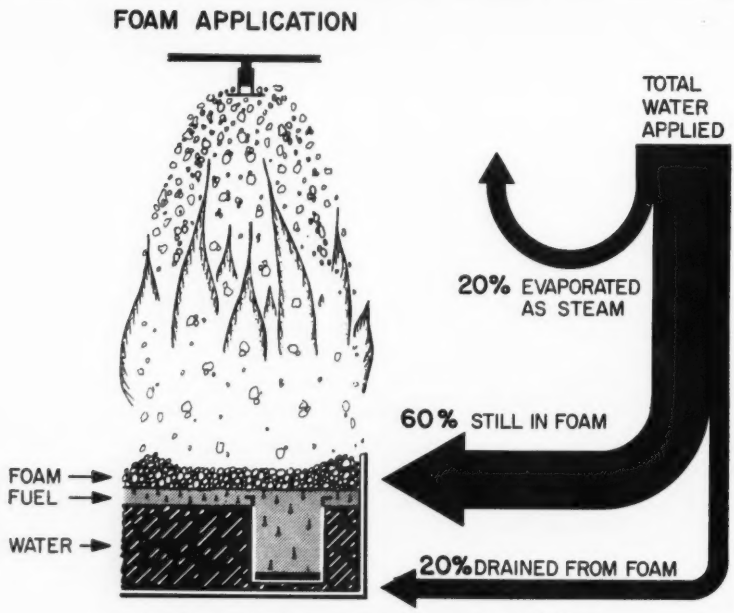
13. Studies made of the water evaporation rates, water retention in foam, and water drainage with the different agents used produced the following values when sprinklers were located 20 feet above the deck (floor) and the water rate was 0.22 gallons per minute per square foot:

	Extinguishing Agent	
	Foam-Water	Water Spray
Water evaporation in vapor form in air space above deck (floor)	20%	80%
Water retention in foam blanket	60%	....
Water lost through drainage	20%	20%

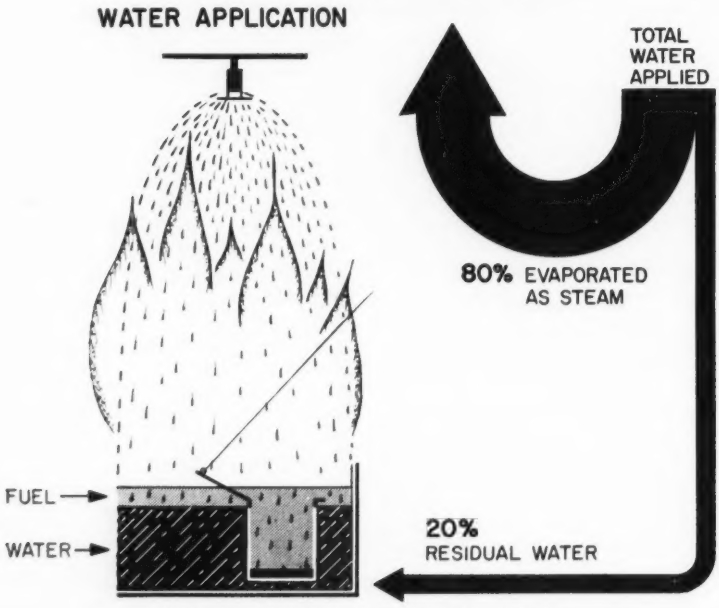
This indicates that applying water in the form of foam provides a method of preservation of the water while it passes through the hot thermal zone above the fire. This is important since the primary value of foam in fire extinguishment is achieved by its water retention capability. The water content of foam keeps the foam fluid and resistant to burn-back. Water which drains out of the foam and sinks below the flammable liquid spill is of no value. With water spray, all water reaching the fuel surface (that amount not lost by evaporation) sank directly to the bottom of the fuel.

Summary

1. In summary, it can be said that for cooling of objects in the fire, "shadowed" objects, air temperatures, and overhead structures, foam discharged



Foam-Water Retention Graph — Foam-Water Sprinklers



Water Evaporation Graph — Coarse Water Spray

from the foam-water sprinklers was superior to water spray.

2. Normally one expects cooling to be achieved only through the direct use of the high heat-absorbing capacity of water. Here we have an anomaly. By first converting the water to foam, greatly superior cooling capabilities were achieved even though the water requirements to secure extinguishment were lower. The double-barreled action exhibited by foam in cooling as well as extinguishing is both unique and highly desirable. Recognition of these facts should have a widespread application in industry as well as aboard Navy aircraft carriers or wherever Class "B" fire hazards are encountered.

3. Valuable design data and an increased degree of confidence in foam-water sprinklers were gained through this testing program. A start was also made on collecting data necessary for the calculation of heat transfer data and the rate of evaporation of water to its vapor state for extending the results to other sprinkler heights. It is anticipated that further evaluation work will be conducted before any large-size shipboard installations are planned.

Appreciation

I would like to express my sincere appreciation to those who contributed materially to this project. First, to Mr. O. L. Robinson and his crew at the Underwriters' Laboratories for their forebearance and utmost cooperation. Second, to Mr. Richard Murdoch's group at the Bureau of Ships for having the foresight to plan these tests. Finally to my associates in the Naval Research Laboratory who really went all out on this job.

Full details on these tests are published in the Naval Research Laboratory Report 5139 "A Study of the Characteristics of Foam-Water Sprinkler Systems in Controlling Full Scale Fires", available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. (No. PB 131740)

Upgrading Hotel Fire Safety in Winnipeg

By E. G. Simpson

Engineer of Inspections, City of Winnipeg

Many of you will recall the disastrous hotel fires of 1946 in which more than 200 persons died and scores were seriously injured. I refer to the fires in Atlanta, Dubuque, Saskatoon, and Chicago.* As a result, the Winnipeg Building Commission decided, early in 1947, that an investigation should be made of Winnipeg hotels to find out if they provided reasonable protection against injury or loss of life in case of fire and if not, just what measures should be taken to provide this protection.

I should explain that the Building Commission is appointed by City Council in accordance with authority granted by the Legislature of the Province of Manitoba. The Commission has two specific functions; first, to authorize the use of new materials or methods of construction not covered by the Building By-law, and second, to order alterations and the installation of appliances in buildings which do not comply with the present Building By-law and are considered by the Commission to be dangerous to life in case of fire.

The Commission comprises three aldermen, three private citizens, one of whom is an architect, one a professional engineer and the other a real estate man. The Chairman is Mr. W. D. Hurst, City Engineer and Commissioner of Buildings; his Deputy is likewise a member of the Committee. I am secretary and technical advisor.

To implement the Commission's powers to order alterations, the Winnipeg Building By-law includes a Chapter which outlines procedures to be followed and the types of alterations which may be ordered. For instance, the Commission may order the removal of combustible finishes; the enclosure of stairways and elevator shafts or, alternatively, the installation of smoke barriers in corridors; the rearrangement of exit facilities; the installation of sprinkler and alarm systems and other things to improve life safety standards.

Thus, the Building Commission, by virtue of legislative authority and through the instrument of the Building By-law, is legally able to attack the problem of older buildings which do not meet the safety standards of today's building code.

*For full reports on these fires, see the July 1946 and January 1947 issues of the QUARTERLY OF THE NFPA.

To enclose an existing open stairway landing flush with the corridor wall, an enclosure projection of metal and wired glass was built with automatic door-closing hardware.

Based on a paper presented by the author at the 62nd NFPA Annual Meeting held in Chicago, Illinois, May 19–23, 1958.

Smoke barriers were constructed in corridors of the seven-story fire-resistive hotel which was one of three which was only partially sprinklered (basement and all storage rooms). Long corridors necessitated these smoke barriers which are metal and wired glass with automatic door closures (door wedged open here for photographic purposes only).

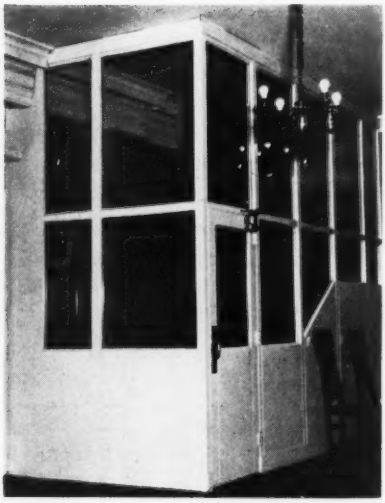
Preliminary Steps

To obtain an impartial opinion of the condition of the fifty-seven hotels in the City, the Commission appointed an Advisory Technical Committee. The members were: Dr. A. E. MacDonald, Dean of the Faculty of Engineering and Architecture, University of Manitoba, who acted as Chairman; Mr. H. E. Puttee, Fire Commissioner of the Province of Manitoba; and Mr. E. J. Parke, representing the Western Canada Insurance Underwriters Association.

It was the intention that the Advisory Committee's responsibility would be limited to an investigation and the submission of a report to the Commission. The Commission could then accept or reject any recommendations the report might contain and the responsibility for subsequent action would rest entirely with the Building Commission.

For more than a year the Advisory Committee worked on the problem and in April 1948 submitted its report in which the following statement appeared:

> "Your Committee inspected exhaustively each of the hotels in the City of Winnipeg, none of which was found to be without fault, and the resulting report is their deliberate and considered



At the mezzanine level this enclosure was built around a previously open stairwell. Other stairwells go to the ground floor. Note that decor is not harmed by enclosure design.

opinion of the minimum general requirements which should be insisted upon for the prevention of human suffering and the preservation of human life, based upon such inspection, practical experience and the lessons to be learned from serious hotel fires which have taken place in Canada and in certain United States cities with consequent loss of life or seriously burned or crippled victims."

The report further stated that the main factors contributing to loss of life in hotel fires appeared to be:

1. Excessive amounts of combustible material.
2. Unprotected vertical openings.
3. Inadequate exit facilities.
4. Lack of automatic detection and extinguishing devices.

As in most cities, the majority of our hotels were of combustible construction, only eight being partially or fully fire resistive. Of the forty-nine combustible buildings, eleven were of wood frame construction with exteriors of brick or stucco veneer, and thirty-eight of ordinary construction.

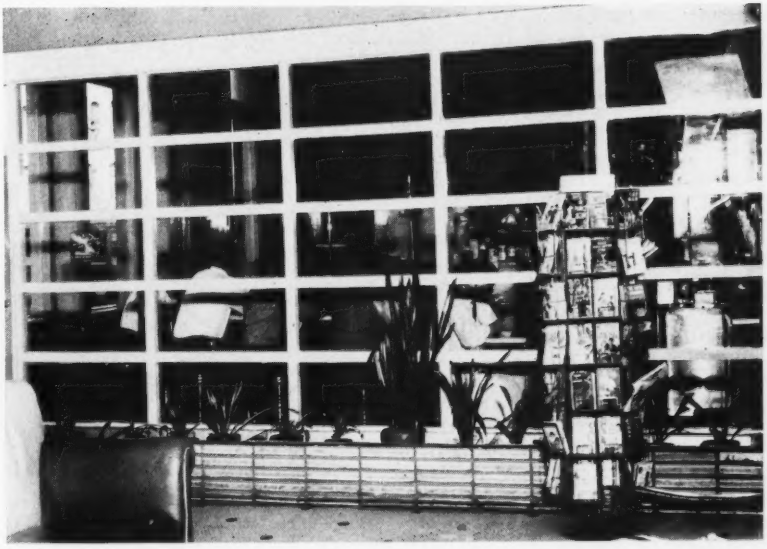
It is interesting to note that your publication, entitled "Hotel Fires,"* has this to say about ordinary construction:

> "Brick buildings whose walls are of substantial construction giving a semblance of fire safety, but whose interior is built to burn..... The old brick-joist type of hotel is encountered in almost every city. Its interior construction is such as to provide for the rapid spread of fire. The combustible material used in its construction, the large number of concealed spaces, unprotected vertical openings, and flammable contents all contribute to making a hot and quick-traveling blaze."

In fact, the hazard to occupancy in buildings of ordinary construction is almost as great as that of wood frame. Experience has also shown us that fire-resistive construction, of itself, is no

*Issued in 1930 and now out of print. For a recent record of hotel fires, order NFPA Fire Record Bulletin FR 56-6 (50 cents a copy).

Metal lath and plaster now enclose the previously open elevator shaft and the open stairwell which encircled it has solid slab doors with wired glass lights at each floor.



The coffee bar and lunch counter adjoining the main lobby in this fire-resistive hotel have been cut off by this wired glass partition and the entire seven-story hotel has been completely sprinklered.

Corridor smoke barrier set in metal lath and plaster partition in a 4-story hotel which is completely sprinklered. Doors are self-closing and labelled NEVER LEAVE OPEN.

guarantee that a tragic fire will not occur. The omission of enclosures for stairways and elevator shafts has been the cause of excessive loss of life in many fires in fire-resistive buildings.

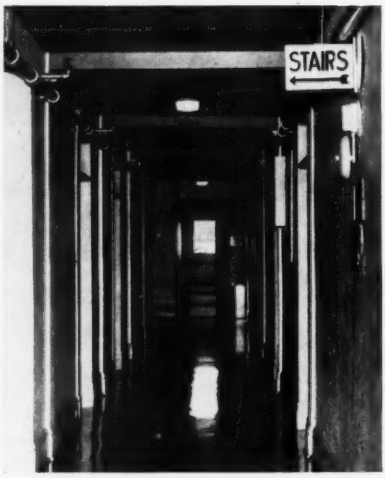
The Advisory Committee took all these factors into account and the whole emphasis of its report was placed upon life safety and the reasonable chance of escape in case of fire. Briefly, the report recommended that:

1. Combustible finishes everywhere, particularly in corridors and stairways, should be reduced to a minimum and all means of egress should be bounded by walls, ceilings and doors, providing a minimum fire-resistive rating of forty-five minutes. Plain glass in transoms, doors, walls or partitions in corridors should be removed and replaced by one-quarter-inch wired glass or equivalent.

2. All hotels, irrespective of height or type of construction, should provide proper enclosures for stairways and elevator shafts where feasible. If proper

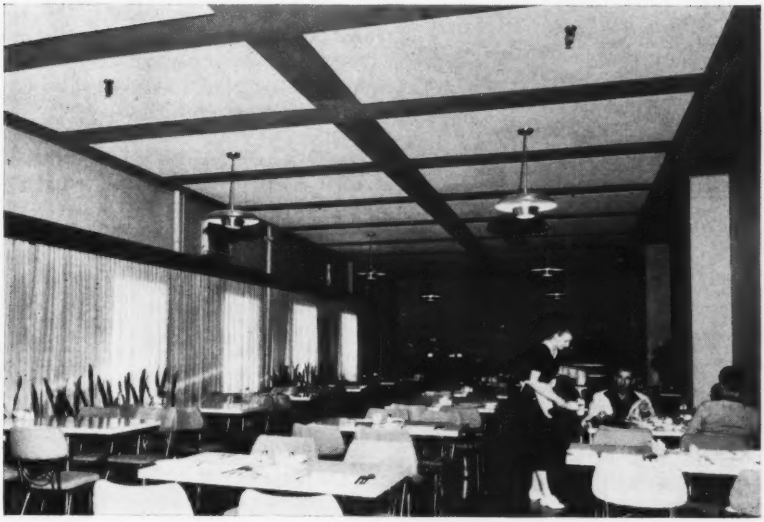
enclosures are not feasible, then automatic sprinkler protection should be provided, in whole or in part, together with smoke barriers in corridors. Doors for smoke barriers or enclosures should be of forty-five minute fire-resistive rating, automatically self-closing and labelled: THIS IS A FIRE DOOR. NEVER LEAVE IT OPEN.

3. Automatic sprinkler protection should be provided in basements, corridors, stairways, and in storage and service rooms of all buildings of combustible construction. Sprinkler protection was also recommended for certain hazardous areas in fire-resistive structures. In fact, a note appended to the report stated that the Committee was of the opinion that the provision of complete automatic sprinkler protection in hotel buildings not of fire-resistive construction, regardless of height, was highly desirable.



A new fire escape door with panic hardware at the end of a corridor.

This 65-room hotel is now completely sprinklered. The new fire escape at left provides egress from an interior stairway running from the 4th to 2nd floors. This stairway, now enclosed, was originally open and necessitated travel along the 2nd floor corridor a considerable distance to an exit. All windows underneath the fire escape are wired glass.



A newly constructed restaurant in a four-story hotel. Note sprinklers, illuminated exit sign and draperies which have been flameproofed.

4. Approved automatic fire dampers should be provided in suitable locations in all ventilating and air conditioning systems.

5. Adequate egress should be provided from all floors or sections. It should be such as to avoid corridor dead ends and fire pockets in which persons might be trapped. Panic hardware should be provided on all emergency exit doors. Illuminated EXIT and STAIR signs should be installed in corridors. In addition, directional signs reading To EXIT should be strategically placed in corridors to indicate the direction to egress to avoid any confusion.

6. Fire alarm systems should be of modern design.

7. Instruction cards, stating what to do and what not to do in case of fire and indicating the direction of exits, should be posted on the inside of all bedroom doors leading to corridors.

8. All hotels should have fire patrols or automatic fire detection systems.

9. Hotel employees should be trained to cope with emergencies such as fire.

10. Finally, there should be good housekeeping, and mechanical, electrical and heating equipment should be maintained in good operating condition.

There were many other minor but, nevertheless, important recommendations. Subsequently, the Report was adopted in principle by the Commission and then referred to the Inspections Branch of the Engineering Department for detailed analysis. The Inspections Branch reinspected each hotel and prepared sketch plans in order to properly analyze means of egress, unprotected vertical openings and other design features.

At the same time, a copy of the Report was forwarded to the Manitoba Hotel Association which represented most of the hotel owners in the city. The executive of the Association was invited to meet with the Commission to discuss the Report. Numerous meetings

Here a central stair and elevator shaft are cut off from the corridors on all floors by this smoke barrier (doors self-closing and held open here for photographic purposes only).

were held and in general, the Hotel Association was of the opinion that the recommendations were too severe in view of the good fire record of Winnipeg hotels insofar as loss of life was concerned. They suggested that if the recommendations were implemented the work be spread over a five-year period.

Finally, on July 30, 1951, a Building Commission Order was issued to each hotel owner outlining specifically what alterations must be made and stipulating that the work must be done within one year *unless* approval was given to extend it over a five-year period. To obtain approval an owner had to submit a detailed schedule of the work to be done each year. All owners chose the five-year plan.

As far as possible the Orders followed the recommendations of the Advisory

Most of the hotels found it advantageous to install complete sprinkler systems. Here is a typical bedroom showing one of the sprinklers. The hotel is a 125-room, 7-story building.

Committee's Report. All hotels were required to provide partial sprinklerization. In the case of hotels of combustible construction, they were required to sprinkler basements, ground floors, stairways, corridors, service and storage rooms. Partially or fully fire-resistive hotels which could not provide proper enclosures or had other design deficiencies had to provide sprinklers where it was thought necessary.

The recommendations covering fire patrols, employee training and housekeeping were outside the legal jurisdiction of the Building Commission and were not included.

Hotel Association Activity

Shortly after the issuance of the Orders, the Hotel Association appointed a committee to further study the matter, and in November, 1951, this committee submitted certain counterproposals to the Commission, among which were the following:

1. That, where a hotel was required to sprinkler corridors and stairways, it should not be required to remove combustible finishes.

2. That smoke barriers in corridors be reduced to a minimum so that they would not be detrimental to the general operation of a hotel.

3. That if an owner chose to install a *complete* sprinkler system, including bedrooms, that he should be relieved from *any* other requirements.

The Building Commission agreed that combustible finishes would not have to be removed from corridors and other places which were sprinklered. It also agreed to reconsider the location of smoke barriers where they might adversely affect hotel operations. Finally, the Commission promised to give very favorable consideration to any proposal for the complete sprinklerization of a hotel and was prepared to waive requirements for the removal of combustible finishes, and the treatment of bedroom doors and transoms. It was even prepared to minimize the requirements for smoke barriers.

New metal fire doors were installed on each floor for this fire escape in a seven-story Winnipeg hotel.

Finally, in 1952, work started and by early 1954 twenty-seven sprinkler systems had been installed and progress was satisfactory on other alterations except in the case of ten hotels. These ten had made little or no progress and were advised that they were not complying with the Building By-law.

The Commissioner of Buildings also advised them that inasmuch as they were not complying with the Building By-law he had no alternative but to refuse to issue them certificates for

licensing purposes under the Hotel By-law.

The ten owners appealed to City Council which agreed to grant temporary licenses, without certificates, providing they started work immediately. Faced with the closing of their hotels, these owners had no alternative but to proceed with the work.

No further difficulties were encountered until late 1956 when it became apparent that some hotels would be unable to finish within the five-year period. Council again granted temporary licenses until July 1, 1957 and on that date work was completed in all hotels.

Results of Program

During the five-year program five hotels went out of business, two of these being destroyed by fire before sprinklers were installed or alterations made. Fortunately, there was no loss of life. The work in the remaining fifty-two hotels was completed last year and has resulted in the following improvements:

1. **All fifty-two hotels have been equipped with automatic sprinkler protection. Forty-nine of these are complete systems including bedrooms and the other three are partial ones.** As I mentioned before, the Commission ordered partial systems installed in all hotels but granted certain concessions where a hotel owner chose to install a complete system. The result is that 94 per cent have provided the maximum protection. It should be noted that NFPA Fire Record Bulletin 56–6 states that in an analysis of 400 hotel fires in the United States and Canada, sprin-

Rear view of 11-story fire-resistive Fort Garry Hotel. Elevators and main stairways are at the front of the hotel but each wing had an enclosed stairway at end of the corridors in the rear. These rear stairs, however, did not extend below second floor. Now egress is much improved by new exit doors and exterior bridges to the enclosed towers which can be readily seen.

kler systems were 97.2 per cent effective in controlling or extinguishing fires in year-round hotels. Sprinklers have already controlled or extinguished nine fires in Winnipeg hotels since this program was accomplished!

2. **All fifty-two hotels are now provided with completely enclosed stairways or smoke barriers in corridors to retard or prevent the passage of smoke or flame, from floor to floor or section to section.** All doors in smoke barriers have the following words painted thereon:

THIS IS A FIRE DOOR. NEVER LEAVE IT OPEN

3. **All elevator shafts have been fully enclosed.**

4. **Plain glass has been removed from bedroom transoms and in all areas bounding means of egress and replaced with shatterproof materials.**

5. **Twenty-three hotels have provided improved means of egress by the construction of additional fire escapes.** These hotels, together with twenty others, have installed metalclad doors equipped with panic hardware, on all doorways leading to fire escapes. In thirty buildings plain glass has been replaced with wired glass in windows adjacent to fire escapes.

6. **Dead-end corridors or "fire pockets" have been eliminated in fifteen hotels** by the installation of connecting passageways or fire escapes.

7. **Illuminated EXIT signs have been installed in all corridors and places of assembly to clearly indicate the means of egress.** Stairs have been equipped with illuminated STAIR signs to indicate their location. In many cases, directional signs have been strategically located in corridors to facilitate egress. Instructional cards have been posted on bedroom doors.

8. **Twenty-seven hotels have constructed new fire-resistive boiler or furnace rooms.**

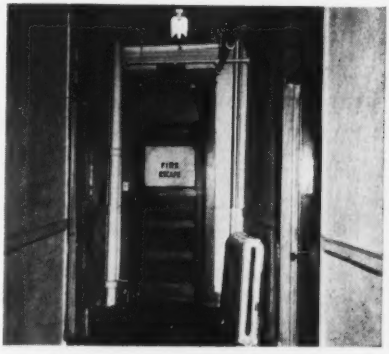
9. **New fire alarm systems have been installed in forty hotels.**

10. Many other important improvements have been made in the hotels which space does not permit listing.

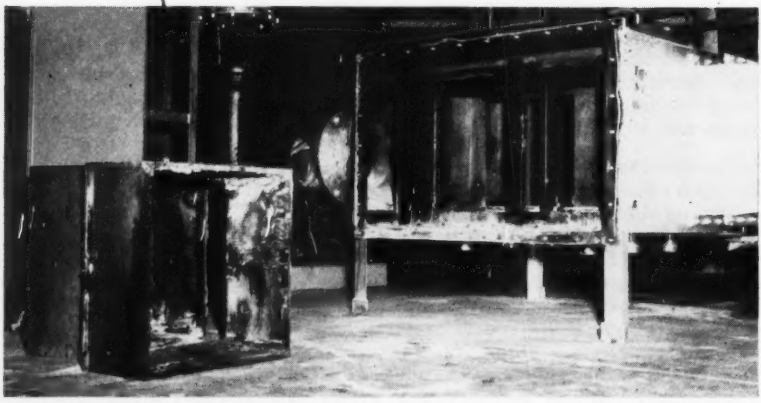
So far, nothing has been said about electrical wiring and equipment. This is, of course, a very important part of any improvement program.

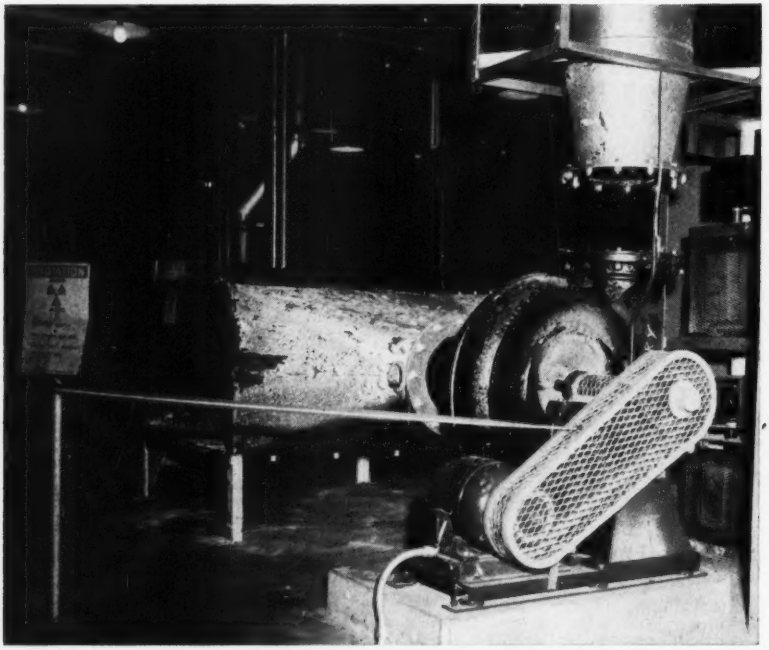
A special electrical inspection was made in 1948 by the Electrical Division of the Inspections Branch. Insulation tests were made on all wiring and electrical equipment was examined. In some cases, branch circuits were found to be overloaded and overfused. Where any electrical wiring or equipment was found to be unsafe or improperly installed, immediate rectification of such conditions in accordance with the Electrical By-law was ordered. This special inspection and annual re-inspections since that time, have resulted in the elimination, to the best of our knowledge, of any obvious life or fire hazards from this source.

It is the opinion of the Winnipeg Building Commission that in case of fire, smoke or panic Winnipeg hotels now provide a measure of protection for the traveling public possibly unsurpassed on this continent.



Exit to fire escape from dead-end corridor. Note panic hardware, exit sign, sprinkler pipe.





Typical small combustible filter enclosures after a fire. In this case four standard sized (24 by 24 by 11½ inch) CWS filters were involved. Both photographs show the effects of the high heat exposures resulting from the fire which was caused by spontaneous ignition of the cellulose filtering media used after contamination by nitric acid fumes. In the top photo it can be noted that the combustible filter frames were intact despite the destruction of the filtering media.

Radioactive Filter Design Fire Problems

By Don J. Keigher, Fire Protection Engineer

Hanford Operations Office, U. S. Atomic Energy Commission

Since construction of the first atomic energy research facilities the problem of filtering exhaust air from spaces where radioactive materials are handled has been recognized. The fire hazards of such high efficiency filters were not as quickly recognized and although an acceptable fire-resistant type filter has recently been developed, one major fire occurred before replacement took place.

The filtering problem for radioactive dusts basically involves three major considerations:

1. The filter must be capable of operating at an efficiency of 99.95 per cent or better on 0.3 micron diameter or larger particle size. This is about a thousand times better than the best electrostatic precipitator can filter.

2. The filter must be reasonable in cost not only because of its use by the Atomic Energy Commission but also because many industries are finding it necessary to filter make-up air in their plants to eliminate the possible introduction of radioactive particles and other contaminants that could have an adverse effect on their manufacturing processes. Such industries include pharmaceutical and biological laboratories, photographic industries and manufacturers of precision machinery and electronic equipment.

3. Three fire problems exist with almost all types of filters. First, filters having combustible components can produce exceedingly hot fires especially where large numbers of such filters must be massed. Even where noncombustible filtering materials are used, entrapped lint, dirt or other contaminants can concentrate combustible materials to a dangerous degree in filter assemblies. Second, in filters entrapping radioactive dusts, a fire can result in potential health hazards and difficult decontamination problems. Whether these contaminants are radioactive or not, they can be the worst aspect of a filter fire. Third, filter fires are unusually difficult to control and extinguish. Access for manual fire fighting is usually limited to one side of the filter or filter bank and in some tests it has been shown that even wet water applied from one side will not penetrate a filter mass. Fire fighting in areas of radiation exposure further hampers such operations because of the need for protective clothing and possibly limited exposure time.

Initial Development of Filter Design

The Chemical Warfare Service developed the original high efficiency filters designed for this special service and they thus became known as the "CWS" filter. This filter (and its somewhat improved but basically similar model designated AEC-1), met the efficiency requirements. They were made purposely combustible so that the extremely scarce and valuable as well as toxic and radioactive dusts entrapped could be recovered when the filter itself was incinerated. Their construction consisted of pleated cellulose-asbestos fibers (10 to 40 mils in thickness) folded around stiff corrugated paper separators, which are attached to the frame by a combustible adhesive. The filter was enclosed in a ½-inch wood frame, most commonly 24 by 24 by 11½ inches in size. This CWS filter could handle 1,000 cubic feet of air per minute and had over 200 square feet of filter surface in each unit.

In 1951 and 1952, Arthur D. Little, Inc., developed noncombustible filter media using glass fibers and a combination of asbestos and glass fibers. Subsequently, flame-retardant treated paper separators were developed, followed by glass fiber separators and then, finally, by asbestos separators. This left only the combustible adhesive and the filter framing as fire hazard problems in the filter design. Dozens of adhesives were studied. The best adhesive now available is still combustible but, by use of an additive, it has been made self-extinguishing following withdrawal of an open flame contact. Frames of various metals and asbestos have been tried but the best developed to date is an impregnated fire retardant treated plywood. A number of these filters for radioactive dusts are now on the market.*

Tests Leading to Improved Filters

At the Hanford AEC plant in Richland, Washington (State) during the period 1953 to date, a series of rather

*Sold under various trade names such as: "Absolute", Cambridge Filter Corp. Syracuse, N. Y. "Air Pure", Flanders Filters, Inc., Riverhead, N. Y. "Ultra-Aire", Mine Safety Appliances Co., Pittsburgh, Pa.

Four of the CWS combustible type high efficiency filters after a flame spread test. These filters had aluminum face plates which turned out to be surprisingly good flame spread barriers despite the combustibility of the filtering media.

Test arrangement at Hanford for destructive fire testing of filter units. Air mover moves 1,000 cubic feet of air per minute through the test filter. Ten pounds of dry shredded paper serves as fuel source. Chicken wire holds the burning paper nine inches from the filter face.

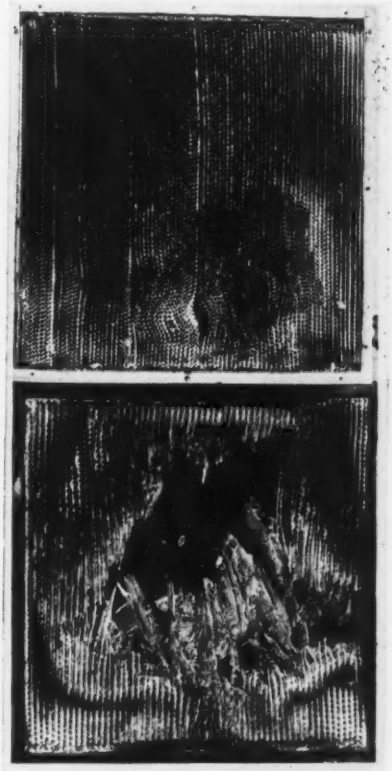
crude filter fire tests has been conducted to gain experience with the problem and to develop fire-safe filter designs.

The first tests proved that flame spread from one combustible CWS type filter to another in a bank was a most serious problem. A second series of tests gave information on those components of the filters available which would break down under heat and flame attack. It is too much to expect that even the best filters could maintain their filtering characteristics under fire exposure conditions but the tests did prove that these improved filters did not contribute fuel to the fire as did the older CWS type and they showed the capability of acting as a fire barrier to prevent further fire spread.

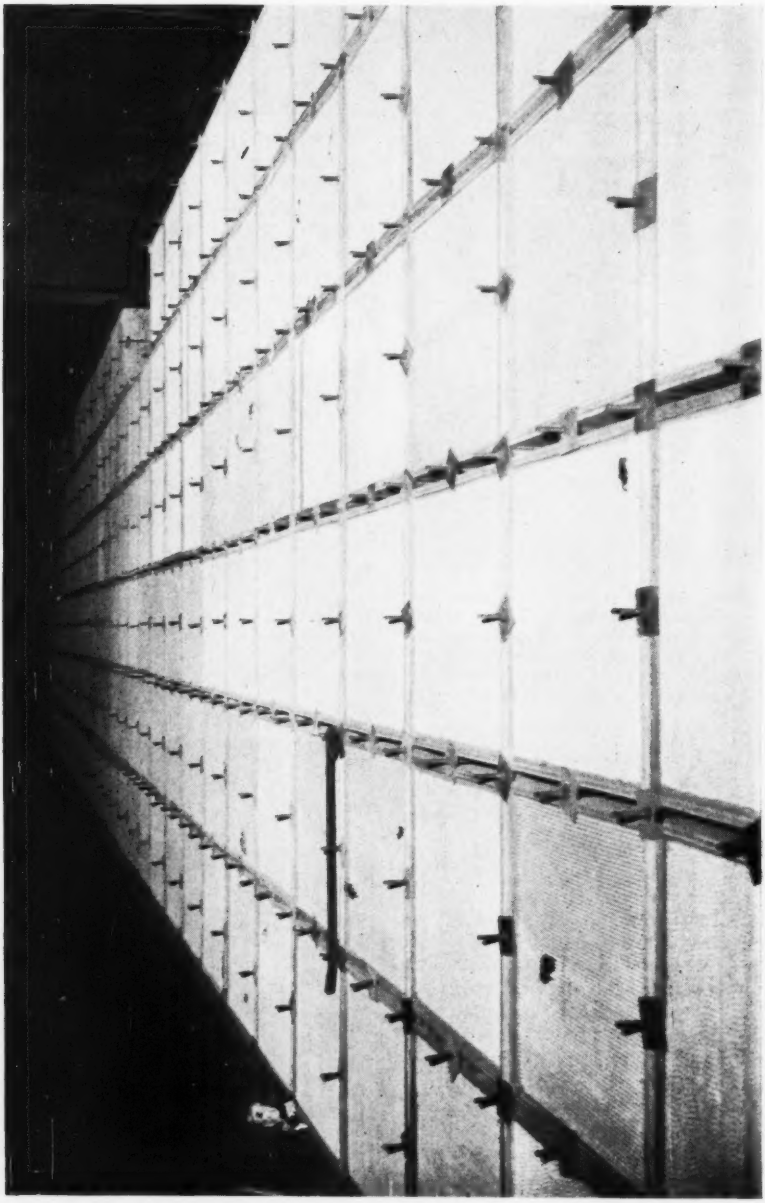
Detailed information on these new filters is contained in "Suggested Specifications for Fire Resistance in High Efficiency Air Filters," AEC Issue No. 77, dated April 4, 1958. Copies are available from the Atomic Energy Commission, Washington 25, D. C.

Conclusion

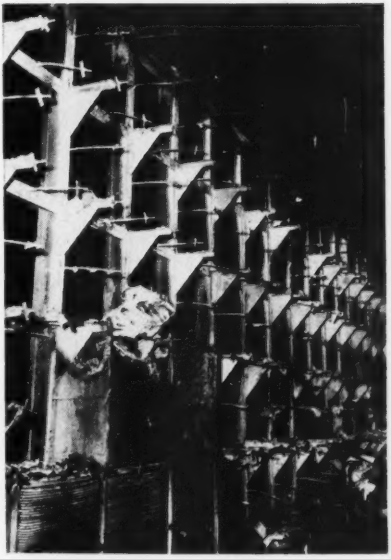
The use of filters of noncombustible media with treated adhesives and frames is highly recommended. The AEC experience illustrates that these filters can be secured at competitive prices to the combustible types, in fact, the current filter used as reported herein for filtering

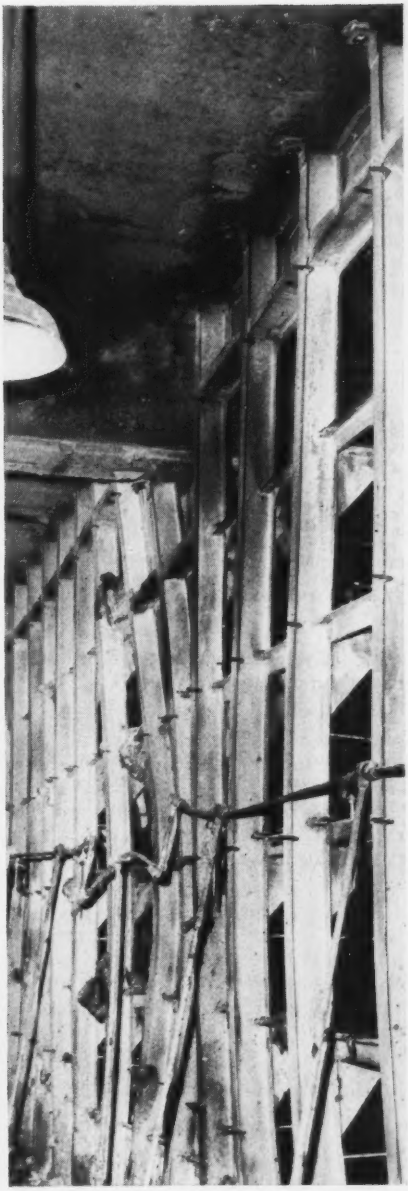


Two of the experimental filters with noncombustible filter media which were tested in the Hanford destruction test series. The upper unit has corrugated asbestos separators and is of the type now specified in AEC Issue No. 77. The bottom unit had aluminum separators which melted away under fire exposure.

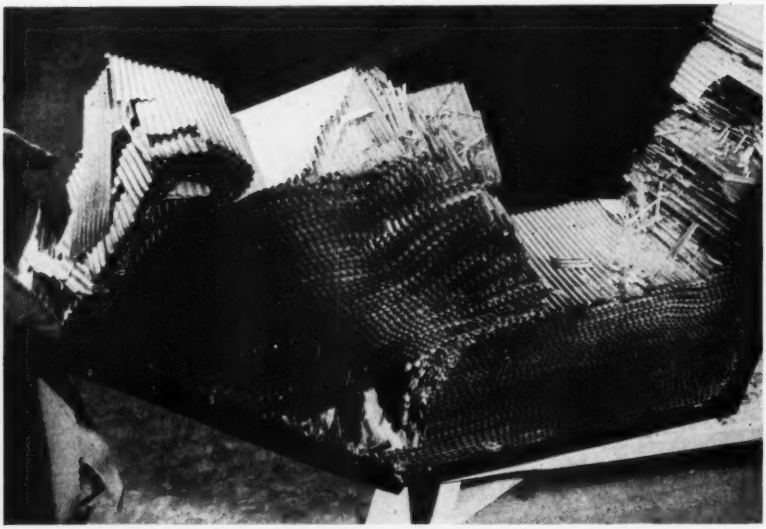


A typical large bank of filters containing hundreds of units each in direct contact with the other without a fire cutoff. A fire involving such an installation would be most difficult to control. (See photos on opposite page.)





Three views of fire damage to a large bank of filters like that shown on opposite page. This bank located in a fire-resistive room, had the combustible CWS type filters and once involved in fire was most difficult to control. Note filter fasteners, warped steel work, and spalled concrete. Clean-up and decontamination was a dirty, difficult task.



Another of the experimental filters with non-combustible filter media tested at Hanford. Here all glass fiber media was used and after destruction testing droplets of glass beads were found where the material fused.

radioactive dusts was 10 per cent less in cost than the competitive CWS type.

To prolong the life of filters, it is recommended that noncombustible prefilters be used. These prefilters can be simply a sheet of glass fiber. They should be located as far as possible from the main filter so that they can act as possible flame barriers.

Install automatic sprinklers in all filter rooms. (Deluge sprinklers would be needed where large combustible filter banks are present.) Do not use these rooms for the storage of other combustible materials or for essential utilities.

Divide large filter banks into sections limiting the number of filters in any one fire area. In Atomic Energy plants 80 to 100 filter units are the maximum authorized without fire division cutoffs.

Prefire planning is important to control filter fires, particularly where large banks of filters may be exposed. Fire departments should work out fire control procedures (spray nozzles) and have preplanned coordination with the ventilation experts operating the units. This latter consideration is vital where radioactive materials are handled. Usually it is necessary to maintain the same or only somewhat reduced air velocity through a system involved in fire. A complete shutdown could cause pressure reversals, spread of contaminants and flashbacks.

Boston's Blighted Boroughs

By Benjamin M. Hermes, Executive Manager
New England Fire Insurance Rating Association

In Boston, as in many other American cities, a serious life and conflagration hazard exists in its "blighted" or depressed sections. This condition is needful of corrective action wherever it exists. Some cities have taken strong action to condemn and remove dilapidated buildings through the combined efforts of Fire, Building and Health Departments but such activity should be encouraged to a greater extent than is now evident.

This story on Boston's blighted boroughs factually reports conditions now existing in the South End and Roxbury Sections of the City. It does not tell of some successful work Boston has done in cleaning up other depressed areas in the East and West Ends of the city or of the recently inaugurated plan to attack the program on a city-wide basis. The Boston Fire Department's work of inspecting and patrolling these areas of high hazard is an established routine until the conditions can be corrected.

South End

There are approximately 3,779 buildings located in the South End Section of Boston of which 2,532 or 67 per cent are dwellings and lodging houses excluding Housing Projects. Of the remainder, 765 or 20 per cent are stores and dwellings, 209 or 5½ per cent are mercantile buildings, 25 are manufacturing buildings, 43 are public buildings (such as churches and schools), and 205 or 5.4 per cent are vacant buildings, many of

Typical of the architectural era of 1860 were mansard roofs and frame exterior attachments such as bay windows. Today these features present major fire control problems.

which are open to the public and exposed to vandalism and malicious mischief.

Buildings 100 Years Old

The buildings in the South End area are, for the most part, 3 to 5 stories in height, of brick construction with ordinary wood joist floors and roof. There is little or no new construction except for Housing Projects. In general, the age of buildings is over 100 years.

Two of the architectural highpoints of the era in which these buildings were constructed are mansard roofs and frame exterior attachments, such as bay windows.

Division Walls Not Through Roofs

Although practically all buildings were originally designed for single, private dwelling occupancy, they were constructed in rows the entire length of the block with no intervening space. The entire block length is of the same height with continuous frame mansard roofs from one end of the block to the other.

The division walls between dwellings do not penetrate the roof boards; consequently, a fire in the upper floors of one dwelling could reasonably involve many dwellings on either side, assuming delayed fire detection or a delay in fire department response. This threat of spread to exposures is, of course, well recognized by the Boston Fire Department which has pre-planned its fire control procedures in accordance with the problem which exists.

Rows of dwellings with division walls not penetrating the roofs.

Rows of empty buildings easy to enter invite vandalism.

Mansard Roofs A Hazard

These mansard roofs present a definite fire hazard in the area regardless of the physical conditions of the property. This problem is, however, particularly pronounced in this section because of the open and abandoned buildings found in row upon row of buildings with this type of roof construction.

Dwellings Converted to Lodging Houses

While most of the buildings were designed, as noted above, for single family occupancy 3 to 5 stories in height, this situation no longer is the case. Most of the buildings are now occupied for lodging purposes or are multiple tenant dwellings. The fire hazard has been increased by the fact that in converting these buildings to lodging purposes, the cheapest of materials and workmanship were very often used.

Light Wood Porches Add to Hazard

When these buildings were converted, frame porches were added at each floor in the rear of buildings, and since the buildings for the most part are in rows,

Frame porches were added when single-family dwellings were converted to multi-family lodgings. Such porches contribute much fuel for fire spread.

these frame porches extend the entire length of the row giving a medium for spread of fire.

Poor Building Maintenance

The buildings are in very poor physical condition. Property decay is almost beyond comprehension. Rent control, with attendant "frozen" rates, plus the ever increasing tax rate, has very likely contributed to the present conditions. Because of the relatively small income derived from these properties, the buildings have not been properly maintained and, during the war years, building materials needed for repairs were unobtainable. There are some buildings still well maintained and in good physical condition, but the owners are suffering because of the disrepair and poor physical condition of surrounding buildings.

Poor Wiring, Housekeeping and Heating

Inspections inside and outside of approximately 360 buildings showed that, with few exceptions, the inside of these buildings had broken plaster, poor electric wiring and poor housekeeping. Many of the buildings that were previously heated by central heating systems are now heated by room heaters.

Oil-Fired Room Heaters

The use of oil-fired room heaters predominates and has been the cause of many fires in the area. Glass jugs and tin cans are used in some cases for the

storage of oil for these heaters and in other cases, oil drums are placed near doorways so as to constitute a life hazard to occupants if the contents should become involved in fire. Many of the room heaters are old and have not been cleaned or properly maintained.

Smoke pipes and metal chimneys are set up with little regard for the protection of life and property. The lack of properly arranged heating devices and proper maintenance is an important factor in the existing conditions.

Owners and Tenants Not Interested

The environment in this area is far below generally accepted living standards. The owners, but more particularly the tenants, display a lack of intelligence or interest as to fire protection, fire prevention and proper maintenance of property.

Exterior Combustibles

Cluttered conditions are allowed to exist in narrow alleys, courts, lanes and yards which are dotted with frame fences and frame outbuildings. Parked cars in many of the areas present a major accessibility problem.

Vandalism a Problem

Vandalism is rampant by gangs who are either residents or congregate here. Many of the structures are reduced to

Poor maintenance, property decay and physical deterioration offer major conflagration potentials.

Loose boards and broken windows show extent of property decay.

mere shambles within a comparatively short time after vacancy occurs. The extensive willful, wanton destruction to the exterior of many of these structures is such as to further place in jeopardy the lives of the fire fighting forces.

Roxbury Section

The buildings in the Roxbury area differ for the most part from those in the South End in that frame construction predominates. While some of these buildings are as old as those in the South End, the majority are less than 50 years old. There are brick rows with frame mansard roofs, but buildings of frame construction separated by open space predominate, except for the main streets.

Combustible exterior rubbish — a worry for the Fire Department.

Two sections of Roxbury are heavily tenanted but have suffered severely through extensive physical deterioration. The structures occupied for dwelling purposes are mostly of frame, joist construction with buildings of two-, three- or six-family units. In another section most of the frame buildings were designed and are still used as one-family

Anything not needed is thrown in the alley.

units, although some of the very large dwellings have been converted to lodging houses or multiple family occupancies. There are numerous streets lined with two- and three-family dwellings. Some areas in this section are very congested, but for the most part there is some open space between buildings which is important in fighting fires as it permits the fire department to work on all sides of a building.

There are approximately 4,506 buildings located in this Roxbury area of which 3,564 are dwellings and lodging houses (excluding Housing Projects), 282 are stores and dwellings, 357 are mercantile buildings, 43 are manufacturing buildings, 92 are public buildings such as churches and schools, and 168 are vacant or abandoned buildings.

This building in good repair is surrounded by combustible rubbish, a threat for fire spread.

Dilapidated Buildings A Hazard

Taking the Roxbury area as a whole the physical condition is better than in the South End with the exception of that part which borders on the South End. Our inspectors found the 168 vacant or abandoned buildings open to the public and exposed to vandalism and malicious mischief. This is a large number of dilapidated buildings for any section of a city but inspection shows that these buildings are scattered and,

A fire could quickly gain headway in this alley.

therefore, do not present an exposure hazard to a degree as great as that in the South End.

In general, the physical condition of the buildings is fair. It is not equal to the better suburban areas but most other suburban areas are not nearly as old. The main blight seems to be these dilapidated buildings which dot the section and which should be removed by demolition.

Area Subject to Depressed Standards

In both of the areas studied, the population is generally in the lower middle-income group. Overcrowding and hazardous conditions which go with depressed living standards are more noticeable in the South End. However, the Roxbury area is beginning to feel the effects of a migration of occupants from the South End. This is particularly noticeable in that part of the area adjacent to the South End and is verified by our inspection reports showing dilapidated buildings and the increase in the frequency of fires as plotted by the Boston Fire Department. If this migration continues, and there is no reason to feel that it will not, a few years could reduce the level here to the mass decay of the South End.

At the present, most of the dwellings are owner-occupied, which is quite different from the South End where most real estate is held for investment. If decay continues, however, owner-occupants lose interest and sell out to speculators whose only interest is in possible financial return rather than financial outlay for improvements.

Fire Incidents Increasing Sharply

Fire Commissioner Francis X. Cotter of the Boston Fire Department has been most cooperative by plotting fires in these areas for the years 1956 and 1957. An examination of the 1956 map shows an abnormally large number of fires, the greatest concentration occurring at the northerly end of the South End area. The picture of the 1957 fires indicates a shocking increase in both areas.

FD Inspections Ineffective

The Boston Fire Department has been particularly disturbed over these conditions. The Department is making numerous inspections of all the buildings, particularly in respect to heating facilities, storage of oil, and rubbish conditions, but finds difficulty in keeping conditions corrected, as apparently occupants are not willing to cooperate, and in many instances where correction should be made by the owner, it is difficult to find the actual owners of the property. Many evidences where fire damage had not been repaired were

Vandalism runs riot in this unfortunate area.

The frame, one-family dwellings show the effect of depressed living standards.

found in the buildings inspected by our engineers.

Insurance Coverage Denied

Insurance companies are refusing to write fire insurance in these areas and have advised the State Insurance Commissioner that this is a direct result of the unfavorable fire loss experience.

Action Needed

Blighted boroughs are not peculiar just to Boston. The ACTION program (American Committee to Improve Our Neighborhoods) is attacking this problem from the moral and aesthetic viewpoints, but each city must take action to clean up these areas because of the conflagration potential such areas present in peace or war (see article on page 53 of this QUARTERLY) and their attendant life hazard to occupants and fire fighters. Many cities now have such programs, including Boston, but immediate action is needed countrywide.

The Nevada Bomb Test Fire Effects

By Kyle P. Laughlin

Fire Research Analyst, Federal Civil Defense Administration

It is well known that fire was the chief factor causing loss of life and destruction of property in the last War. Incendiary bombs started enormous numbers of fires, more or less simultaneously over large areas. Fire was one of the chief effects of the two atomic bomb attacks on Japan.

The ability of modern nuclear weapons to ignite vast areas is sometimes forgotten as the blast damages and the devastating hazards presented by radioactivity are newer and more sensational effects. The fire threat still exists, however, and it therefore becomes of interest to know what fire tests have been made in Nevada and what lessons can be learned from them.

There is much misunderstanding about how atomic and hydrogen bombs initiate fires. The simple fact is that the heat energy in the weapon serves as the match to start the fire. Fires so initiated then behave the same as peacetime fires and depend for development on target characteristics, such as the congestion and combustibility of buildings, weather factors, and the like. It is the energy in the target that causes devastating fires following attack. The only difference between the fire effects of a hydrogen weapon and an atomic bomb is that the bigger weapon starts fires over a greater area.

It is also not always realized that effective fire control measures useful following A-bomb attack would still be effective against the larger H-bomb. In the area of partial damage, which would be many times larger than the area of complete destruction whatever the size of the bomb, any success in the prevention of individual fires would have a great effect in reducing loss of life and fire destruction of property. Furthermore, the probability of lethal radioactivity in many such areas, which would prevent active fire fighting, emphasizes the importance of measures which would keep fires from breaking out in the first place.

Series of Fire Tests

In fire tests carried on in 1952 and 1953, prototype frame houses were exposed with highly combustible interior furnishings and exterior kindling fuels, such as dead grass, discarded papers, rotten wood, and other useless materials. These tests were significant in demonstrating that in areas beyond complete blast destruction, initial fires will start only in the highly combustible materials aforementioned, and from these fires, solid combustible material would later be ignited. The results of these tests were presented in the picture "The House in the Middle."*

Industry Participation

In 1955, further heat tests were conducted in a program called "Thermal Ignition and Response of Materials," supervised by the Atomic Energy Commission and managed by the Federal Civil Defense Administration. This program was made possible in a large measure through the participation of business and industry. Over 200 companies and associations participated in these tests. Of the total technical project personnel involved, over 100 were from industry.

Based on a talk by the author presented at the 62nd NFPA Annual Meeting held in Chicago, Illinois, May 19-23, 1958.

*Available from Capital Film Laboratory, Inc. 1905 Fairview Ave., N. E., Washington, D. C. Cost: $41.20. Also available through Civil Defense Offices.

In the thermal tests, the companies and trade associations involved included the Association of American Railroads, the Kaiser Aluminum and Chemical Corporation, the American Association of Textile Chemists and Colorists, L. A. Darling Co., J. C. Penney Co., Union Carbide and Carbon Corporation, and the Society of the Plastics Industry. The Naval Material Laboratory of the New York Naval Shipyard, and the Forest Products Laboratory of the Forest Service, U. S. Department of Agriculture, assisted materially in evaluation of the results.

The primary purpose of the tests was to gather additional technical data on the ignition of material exposed to the heat of bomb detonation and to translate these data into actual situations which would provide useful information for prevention of fire and protection against fire effects.

Problems of Testing

Many factors are involved in any such test program. These factors may vary from day to day, and even hour to hour, and they have an effect on the validity of the tests. They must be taken into consideration both in planning and in interpreting the results.

The *purpose* of the test had to be kept clearly in mind in setting up the test location, conditions and instrumentation. In the main, the heat effects in the areas of partial to slight blast damage constituted the most useful data. Consequently, the expected "yield" (thermal energy) of the weapon had to be determined in advance before the exposure distance of target combustibles from ground zero could be selected. Miscalculation as to the bomb "yield" and distance could very well invalidate the results.

By the use of scaling laws, the distances at which fuels can be expected to ignite may be predicted with qualifications. These distances could be influenced by many variables, such as the length of the thermal pulse during which time the heat energy will be delivered. With an atomic bomb of the size used in Japan, the heat wave was completed in about one second, but heat is radiated over a longer time as the bombs proceed into the megaton range. The effect of changes of this and other variables has been averaged from available fuel data and applied to fuels for which there is no test data.

The installation of all thermal tests must take into consideration blast pressures at the locations selected, and the tested objects have to be anchored strongly enough to withstand the expected pressures without destruction.

Delays in testing are often met in Nevada because of adverse weather conditions. Wind and rain damage to the objects being tested and dust blowing on samples can provide insulation which would influence results.

Operation Teapot

The broad guidelines for practical fire prevention measures were made clear by the 1953 tests. The following tests made in 1955 in the Operation TEAPOT series provided sponsoring industries with some useful and significant details not available to them before, for example, the relative effect of heat on many types of plastics and fabrics.

Stake Line Test

This test was designed to provide information on the degree of damage to wood surfaces exposed to a wide range of thermal energies.

Stakes of Ponderosa Pine and Douglas Fir located at 2,500 feet were the closest to the bomb to be recovered. They were deeply ridged and roughened which may be ascribed to sand blasting.

The effect of char and scorch was less up to 3,500 feet from ground zero than beyond 3,500 feet. It appeared that the blast wind at close range had the effect of terminating the thermal action before it had run its course. There was no reason to conclude from the evidence of these tests that thermal action was

Beginning at 1,000 feet from ground zero, stakes of Ponderosa Pine and Douglas Fir were placed every 500 feet along a radial line back to 12,000 feet. A two-inch strip of aluminum foil was placed around each stake to protect a portion of the surface for comparative purposes. Each stake was anchored by two U-bolts to a "T" section steel fence post driven several feet into the ground.

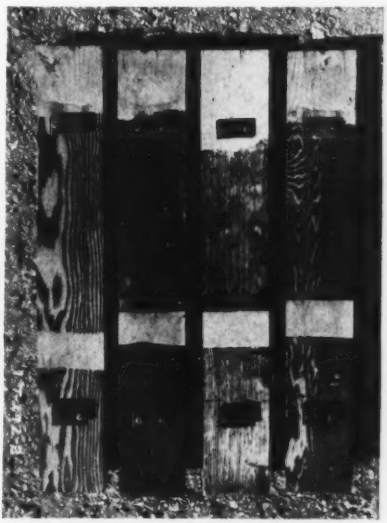
greater with one type of wood than with the other.

The result confirmed earlier findings that solid wood surfaces and solid combustible building materials in good condition will not be ignited directly by thermal radiation beyond the range of complete blast damage and that continuing fires would be started principally by the ignition of "kindling fuels."

Treated Timber Piling Test

This test was set up by the Engineering Division of the Association of American Railroads. It consisted of the exposure of ten heavy pile stubs at three different locations from ground zero. The piles were treated similarly at each location. The object was to observe the behavior of treated timber piling used in bridge construction when exposed to the heat of an atomic device. In addition, information was sought on the effectiveness of white pigmented fire-retardant coating material in comparison to black pigmented material of the same chemical composition.

Various methods have been used for about a century by the railroad industry for preserving its timber structures.



Condition of stakes located 6,000 and 6,500 feet (left to right) from ground zero after the blast.

One of the three stands of timber piles. The pile stubs were 8 feet long and were buried in holes 4 feet deep. One pile was untreated and used as a control. Three piles were treated with creosote; three with a mixture of 60:40 creosote:coal tar and three with a 50:50 mixture of creosote:petroleum. One of each of the three was treated with white paint; one with black paint; and one was left unpainted.

Treated timber has a useful life ranging up to 50 years; untreated timber less than 10 years. During most of the past 75 years, creosote has been used alone for treatment, but recently creosote has been combined with coal tar and Bunker-C fuel oil.

The results showed that the white fire-retardant coated piles were undamaged at all locations. The greatest effect was shown on the black painted specimens. The creosoted piles were less severely damaged. Least damaged were the creosote-coal tar treated piles. The untreated pile exhibited surface char of minor depth.

This test emphasized the value of white pigmented fire-retardant material in resisting the thermal effect of the atomic device. Any satisfactory fire-retardant coating other than white would serve the purpose if an inexpensive white top coat were applied to

This plastics stand was located 6,600 feet from ground zero. Film and elastomeric type materials were cut in uniform sizes and placed in specially constructed test frames. Rigid materials were cut to size and trimmed for hanging on the test racks. Various thicknesses and colors of all types of plastics hung on heavy duty wire strung between upright pipes and were designed to swing freely with the blast wave.

offer the reflective benefits contributed by white pigmentation.*

Plastics Test

The object of this test was to evaluate the heat effect on samples of plastic materials which are now on the consumer's market as well as those widely used in industry. Over 200 samples of plastics were exposed at three different locations.

The degree to which the plastic samples were influenced by the heat of the bomb depended upon the type of material, the thickness, the color and the distance from ground zero. In general, thermoplastic materials were more affected by the nuclear heat than were the thermosetting plastics. In all cases, white and transparent samples exhibited less distortion, burn and melt than did the darker plastics. The heat effect varied widely with thicknesses and was influenced by the characteristics of the various families of plastics.

It should be noted that the record of thermal action on the individual exposures was completed prior to the arrival of the blast wind which bent the upright iron pipe, damaged many of the frames, and broke some of the wire on which the frames were strung.

Fabrics Tests

The object of these tests was to study the behavior of many types of fabrics used as civilian apparel when subjected to various heat intensities. While numerous tests have been conducted on the effect of heat on materials used primarily for military use, the textiles exposed here had not been tested before. Furthermore, it was of interest to determine in a general way, the degree of heat penetration through one or more layers of clothing to the skin of the wearer.

Instrumentation consisted of black paper strips with numbers printed on them in a white mixture which melted and disappeared at temperatures ranging between 63 and 256 degrees Centigrade (145 and 493 Fahrenheit). These papers were developed by the U. S. Army Quartermaster Research and Development Command for just such a purpose. They were placed beneath single and multiple layers of clothing on both plaques and mannequins.

As a secondary check on these temperature indicators, the plaques and mannequins were painted with a green pigment paint developed by the Chemical Warfare Service, U. S. Army. Heat caused the green paint to change shade ranging from pink to fairly dark red.

Dark colored fabrics were more damaged than those of light shades. Black wool was severely damaged. Cottons were damaged to a much greater extent than wool and on the cotton prints, the dark designs were burned out. Heavier fabrics stood up better; "flameproofed" fabrics appeared to have some value, but flameproofing did not necessarily prevent scorching. Most of the synthetic fibers melted or fused, especially the dark shades; however, a white nylon denim was undamaged.

Several layers of fabrics increased protection even when outer synthetic fabrics fused and disappeared. White cotton knit underwear layers underneath outer fabrics remained undamaged or slightly scorched. Clothing on mannequins behaved in the same manner, but was damaged to a lesser degree, partly due to folds and air spaces.

The results of the temperature indicators in measuring temperatures attained was by no means perfect but checked fairly well with changes of color of the paint indicator. Behind lightweight, thin cotton prints exposed at 7,000 feet from ground zero, the indicators read 256 degrees Centigrade (493 degrees Fahrenheit) and the clothing was not scorched or damaged. Dark

*Editor's Note: In the absence of comparative tests with ordinary white paint, it would appear to be impossible to determine the added protection afforded by the white fire-retardant coating.

One of the three stands of fabrics consisting of materials mounted on plaques and mannequins dressed in several layers of clothing. One-half of the surface of each plaque was recessed to simulate the effects of folds and air space between garments. The racks were anchored to ground with cable and iron stakes to resist blast effects. The upright portions on which the plaques were nailed were hinged with the base and were held up by nylon cords. With the blast the nylon cords broke allowing the uprights to collapse thereby avoiding blast damage to the exposed samples.

The only mannequin that burned. The construction of this mannequin was responsible for the fire since an air space existed between the torso and limbs which was covered by a cotton work suit.

wool fabrics, however, were harsh and brittled when the temperature indicators beneath them registered 204 degrees Centigrade (399 degrees Fahrenheit). When the same temperature was registered under white wool, the wool was not damaged. White, lightweight porous rayon fared well without burning or scorching when the temperature indicators registered close to 256 degrees Centigrade (493 degrees Fahrenheit). Darker shades, however, burned away.

Window Protective Tests

These were the most significant tests from the point of view of practical fire prevention measures. They were set up to measure the relative reduction in heat penetration afforded by certain materials commonly found on window openings, and the value of simple coatings which might be applied to window glass under emergency conditions.

The instrumentation was provided by calibrated papers furnished by the Naval Material Laboratory, New York Naval Shipyard, and this laboratory later studied the results and tests, and verified the evaluations made in the field.

TABLE 1. EFFECT OF HEAT ON VARIOUS PAPERS

No.	Type of paper	Description of effect	Critical exposure (Calories per Square Centimeter)
1	Permapaper (Sanborn Recording)	Begin to blacken	0.63
		Turns solidly black	
		green lines disappear	0.96
		Char through	1.6
		Burn through	2.8
2	Black matte paper	Burn through	3.0
3	Vesicent Detector Paper (M-6)	Turns orange	0.96
		Turns brick red	2.5
		Destroyed	18.0
4	Bond Paper, 25 per cent Rag Cherry	Initial effects, char	5.9
		Burn through	8.1
5	Bond Paper, 25 per cent Rag, Pink	Initial effect, char	6.9
		Burn through	9.1
6	Bond Paper, 25 per cent Rag, Yellow	Initial effect, char	8.3
		Burn through	10
7	Bond Paper, 25 per cent Rag, Buff	Initial effect, char	9.2
		Burn through	16
8	Cardboard, U. S. Postal Card	Initial effect, char	14
		Destroyed	21

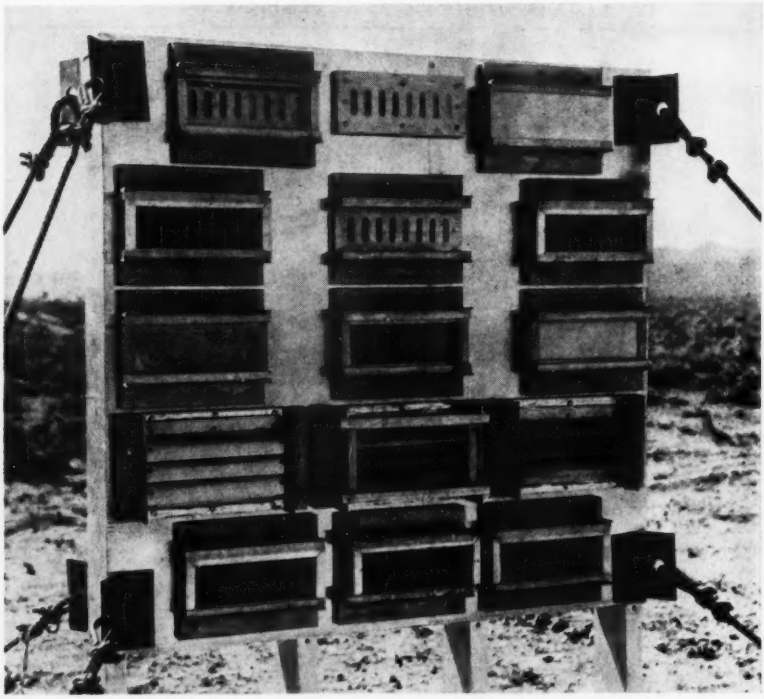
The individual paper strips reacted differently to changes in radiant exposure. Table 1, compiled by the Naval Material Laboratory, was used as a guide for interpreting the total heat energy received by the papers within the time period involved. (The actual time factor was less than a second.)

Two of the panels on each rack were exposed directly to the heat wave, and these panels acted as controls for the determination of radiant energy excluded by window protective material. For example, if the control panel read 17 calories and the controls behind the window glass coated with opaque paint read 10 calories, the protective factor for the opaque paint was 41 per cent.

It is interesting to note that there was a satisfactory correlation between the calibrated papers used in this test and the thermal radiation measurements obtained from the thermopile indicators which were installed to measure total thermal energy as a function of distance.

The conclusions from the window protective tests, after evaluation in the laboratory, permit the following conclusions. Ordinary window glass reduces thermal radiation by only a small amount. The reduction of radiation and the protection of highly combustible interior furnishings can be readily and very effectively increased by means of venetian blinds or by insect screens and glass coatings. As would be expected, venetian blinds with closed slats preclude the passage of radiation completely, but slats positioned at 45 degrees allow the passage of enough radiant energy to damage interior combustibles.

The use of aluminum shade screens and insect screenings reduce harmful radiant energy by from 35 to 65 per cent depending on the mesh. Of the three window glass coatings tested: whiting and water, household cleanser applied with a brush and a commercial opaque paint, the whiting was by far the most successful and reduced radiant exposure



One of the five window protection test panels. The samples consisted of plain window glass, venetian blinds closed and partially opened, aluminum sheet screens of various gauges, insect screens and window glass coated with various types of handy household materials. They were set in slats of aluminum with the samples in front of instrumentation panels. The racks were sturdily built, covered with aluminum sheeting and guyed securely with cables to deadmen buried four feet in the ground.

by approximately 90 per cent. The other window protective coatings were less effective.

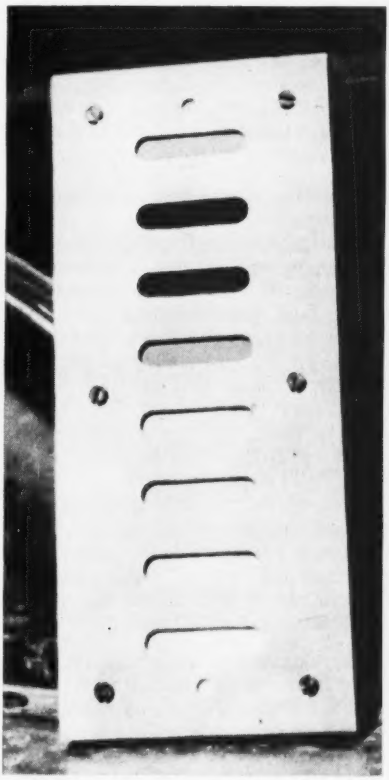
The effectiveness of whiting and water as a window protective coating compares very closely with tests made by the English using white-wash on windows. The result of their experiment suggested that the use of white-wash would reduce radiant exposure by approximately 80 per cent.

Use of white-wash is being given a considerable amount of emphasis by the English in popular pamphlets which have been prepared by the British Home Office.* With their experience in the use of black-out curtains during World War II, the English know that simple measures such as this pay off, and can be explained easily to people as a very effective means of reducing markedly the number of fires which would be initiated by the bomb.

Blast Disruption as a Cause of Fire

The tests which have been described were designed to provide information on the initiation of fires from the direct

*See, for example, "Elementary Fire Fighting" Scottish Home Dept. of Civil Defense, Handbook No. 4., Her Majesty's Stationery Office, 1957.



Each instrumented panel had eight kinds of paper to record radiant heat effects through the openings, each of which simulated a different window protective technique.

heat effect of a bomb. A second cause of fire from nuclear attack would come from blast disruption. While some tests in Nevada have involved the installation of utilities which might, if broken, have caused secondary fires, such tests were set up to demonstrate blast effects and not fire probability, and no fires occurred. It would be impossible to derive any statistically significant data from single test fires if started by blast disruption which would have meaning for the protection of American cities.

The best data in this field must still be considered the studies made by the English on fire incidents in London caused by buzz-bombs in World War II. Relatively few fires occurred, but it is entirely possible that with different types of construction, different heating arrangements and very dry weather conditions, there might be more fires from this cause than there were in London.

How to Predict and Avoid Fires

With the experience gained in the many tests that have been held, fire from the heat effects of a bomb has been predicted and avoided in the desert when desired. It simply meant the elimination of exterior kindling fuels and the protection of combustibles on the interior of buildings.

Observers at public tests sometimes forget that there is a fire problem from atomic bomb action as they see no fire resulting from the test. They do not realize that there could have been fires in test buildings containing highly combustible contents if the window openings had not been protected with closed venetian blinds or protective coatings on the window glass.

The thermal energy received by the test structures in the 1955 series was more than enough to ignite kindling fuels. As it was, the only fires that occurred were in Joshua trees as far back as 7,000–8,000 feet from ground zero, and the one mannequin located at 7,000 feet which has been described.

What Can Be Done

The basic fundamentals of initiation of fires from the direct thermal effect of nuclear attack are known, and point clearly to the prime importance of clearing useless materials and old, decayed combustibles outside of buildings, the prevention of heat radiation from penetrating into buildings by shuttering or window protective coatings, and the reduction in the use of combustible materials. By practicing these principles we will succeed, not only in lowering our peacetime fire losses, but in doing the best things possible for war emergencies.

Identifying Fire Hazards of Materials

By J. S. Queener, Chairman

NFPA Committee on Fire Hazards of Materials

In the July, 1954 (page 57) and the July, 1956 (page 65) QUARTERLIES, I have reported the work of the Sectional Committee on Classification, Labeling and Properties of Flammable Liquids. These reports were of an informal nature indicating the problems that existed in attempting to establish classifications of flammable liquids to describe adequately their fire hazard properties.

The NFPA Board of Directors were requested at their July, 1956 meeting to broaden the work which we had done on flammable liquids to apply to all classes of materials — solids, liquids and gases. This step was approved by the Board (see October, 1956 QUARTERLY, page 125) in recognition of the need for identifying the hazards of all materials rather than restricting this activity to flammable liquids alone.

Basically, the committee has four objectives in mind in attempting to arrive at methods of identifying the fire hazards of materials. These objectives are:

1. Identification of the hazard of materials under all conditions.

2. Utilization of an identification system which will find general acceptance for all concerned in evaluating the hazard of materials.

3. An identification system possessing uniformity so that it can be applied to all types of materials and be instantly recognizable to those concerned with the problem.

4. An identification procedure which will be adaptable to simplified use.

The work of the committee, as originally constituted by the NFPA Board of Directors, was delayed in the early phases of our considerations by considerable discussion on what was meant by the word "classification." This word was used in the title of our Committee as it was originally established (Committee on Classification of Materials). The problem was resolved by action of the NFPA Board of Directors at their January, 1958 meeting (see April, 1958 QUARTERLY, page 223), wherein the name of the committee was changed to its present title, "Fire Hazards of Materials." This permitted the committee to look at the problem in better focus and to concentrate on achieving the objectives of the revised current scope statement which is to "develop methods for evaluating and indicating the fire and related hazards of materials."

The Committee feels that there are three main characteristics of materials which must be understood if one is to evaluate properly their fire hazard characteristics. These three considerations are:

1. Flammability
2. Stability
3. Health hazard

Subcommittees have been formed to investigate each of these three characteristics and each of the subcommittees has reported progress on its work although each recognizes that considerable research remains before any conclusions can be reached.

One of the subcommittees, as indicated above, is concerned with the problem of the stability of materials. This subcommittee has drafted a tentative definition of stability and reactivity so that it might proceed with its work in this field. The definitions proposed are as follows:

"Stability is the quality of a material to resist exothermic chemical change. Stability implies resistance to decomposition, polymerization or condensation, auto-oxidation-reduction, etc.; changes which involve the material alone or in the presence of catalysts-autoreaction."

"Reactivity, as it pertains to stability, implies ability to enter into a chemical reaction with other materials. (For purposes of fire hazard identification, the other materials primarily to be considered are water and other extinguishing agents)."

With regard to possible application in a system or method of symbolization, the aspects of stability are ranked in the following categories according to the ease, rate, and quantity of energy release:

0. Normally stable and not reactive with H_2O
1. Will undergo chemical change slowly at elevated temperatures or pressures.
2. Will react with water with release of significant quantities of energy.
3. Will undergo chemical change violently at elevated temperatures and pressures or rapidly at ordinary temperatures and pressures. Shock sensitive under confinement or at elevated temperatures and pressures.
4. Capable of detonation or explosive decomposition or reaction under normal temperatures and pressures.

The Committee recognizes that conferences with groups outside of the structure of the NFPA technical committee activity will be necessary and desirable. This pertains particularly to our consideration of the health hazard category where we will need assistance from physicians and hygienists.

This is a very brief indication of the nature of our current work in this field. The Committee hopes that it will be able to draft a method of identifying the fire hazards of all types of materials which will be so helpful that not only other NFPA committees, but other agencies interested in safety, will find the identification method so advantageous that it will have world-wide acceptance. The committee's objective is simply to obtain an improved degree of fire safety in the handling of materials and the committee's purpose basically is to protect the lives of those engaged in fire fighting who today are faced with many hazardous materials, the nature of which is not clearly identified by any method.

We realize that the problem is not one exclusively for the committee itself and we invite suggestions or comments from all readers of the QUARTERLY as to possible approaches to this important problem.

Building Code Criticisms Often Misdirected

By Horatio Bond

Chief Engineer, National Fire Protection Association

The most serious charge which is leveled against building codes is that they somehow unnecessarily increase the cost of building construction. Most persons advancing this criticism, however, mean that the cost is increased to the extent that a safe installation specified by the building code is more expensive than a less satisfactory arrangement which could be used in place of the one specified. The usual "increased cost" argument is prompted by people who are interested in the sale of products or are interested in practices which do not give the minimum safety which is needed.

For example, the wood shingle industry considers completely unreasonable the provisions of building codes which prohibit wood shingles as roofing. Wood shingle roofs have been responsible for the burning of many cities in the United States and elsewhere, and there is general agreement that it is too dangerous to have a combustible roof in a congested area. Many cities prohibit wood shingle roofs, not only in congested areas, but throughout the city limits. This is because numbers of wood shingle roofs produce fire situations which would be unmanageable by the fire department.

Prohibition of wood shingle roofs actually reduces the cost of buildings and at the same time achieves safety. If wood shingles are permitted, a large item of additional fire department cost is incurred to provide safety equivalent to that which prohibiting the roofs would accomplish.

Based on remarks made by the author at the HOUSE AND HOME Round Table on Building Codes held on May 21, 1958 at the Savoy Plaza Hotel, New York, N. Y.

Quick Burning Finishes

Some years ago, a visitor brought in a sample of a structural panel which he felt had merit for possible use for flooring and walls in dwelling houses. It was made of paper cells held together with a resinous substance to provide slabs 1½ to 2 inches thick. With this assembly of materials it was perfectly possible to get the desired strength for dwelling and other floors. The panels had excellent acoustical and insulation characteristics. They would provide wall and floor surfaces which would undoubtedly be very comfortable in a dwelling, and they perhaps had other advantages. Here was something cheap, good in many respects. But a building code would properly prohibit its use. This particular panel would be so quick-burning as to collapse early in a fire and it would undoubtedly cause loss of life in any building to which it were applied.

A typical loss-of-life fire in a dwelling is one in which fire starts while people are asleep. Another starts during the absence of adult members of a family. A heating plant is often a contributing factor. The real cause of the loss of life often is in the quick-burning features of the building construction. Paperboard wall finishes, combustible wallboards with fuzzy surfaces, and plywoods which delaminate under heat, are examples of wall finish boards which are so quick-burning as to produce an unsafe condition wherever they are used.

Restrictions on the use of these types of materials have been vigorously fought. It is easy to understand that a person interested in the sale of such materials would feel that a building code provision which restricted their use was favoring other materials, the

cost of which might be greater in individual instances.

There are numerous like cases where a line must be drawn between safe and unsafe building assemblies. Once the line has been drawn, the cost factor is something else. It isn't fair to say that because the safe and proper type of construction is specified, the building code is unreasonably increasing costs.

Building Codes Not Always Culprits

Therefore, look for an ulterior motive behind most of the criticisms of building codes. Many defects charged against building codes are not valid ones. The charge of increased cost often ignores the increased cost of fire protection if reasonably safe conditions are not specified in the building code.

Typical of misdirected criticism of building codes is a comment by Stuart Chase in an article entitled "How Up-To-Date Is Your Town's Building Code?" in the February, 1958, issue of READER'S DIGEST. Mr. Chase says, for example, that two major disasters woke up the nation to the hazards of obsolete codes. One he mentions was the Cocoanut Grove fire in Boston in 1942 where 492 persons perished, and the other was the Hotel Winecoff fire in Atlanta in 1946 in which 119 guests were trapped and killed on upper floors.

The facts of the matter are that both at Boston and at Atlanta the building codes, as documents, were very good. Mr. Chase made the assumption that the building codes were somehow at fault when actually the difficulty was in another direction. In these cases the local fire and building department officials neither identified the life hazard nor did anything about it.

The point is that we have got to look elsewhere than at the building codes for the seat of troubles such as those which exercise people from time to time.

The four following suggestions are offered to improve the situation with respect to building codes and their enforcement.

Enforcement Organization

First, a look should be taken at the organization of the building code and fire prevention code enforcement problem in each city. Improvements could often be made by reducing the number of departments with which the property owner has to deal. These can be limited to a fire prevention bureau in the fire department and a building department.

Uniformity of Codes

Second, uniformity in provisions of building codes should be obtained through the wider use of standards which are available from the National Fire Protection Association and others. Also, uniformity can be promoted by the use of one of the so-called model building codes which are offered as a guide to cities.

Uniformity in the enforcement of fire prevention regulations by cities has been promoted for many years by the fact that in most states there is a state fire marshal's office assisting in enforcement of fire prevention regulations. In the building code field this sort of thing has been much less common, although a number of states have state agencies serving all of the municipalities in the state which have building codes. A notable example of this sort of thing is the New York State Building Code Commission. The Provincial Fire Marshal's Office of Ontario is another.

The advantage of a state agency in the picture is that it can furnish important technical assistance which the small fire and building departments of the various cities cannot ordinarily afford to maintain. A state agency to support city fire and building departments does much to promote uniform handling of fire and building regulations.

Competence of Enforcement Officials

Third, it is very important that the official in charge of the fire prevention

bureau in the fire department and the official in charge of the building department of a city be technically competent persons. The competence of an enforcing officer has more to do with the success or failure of the operation of building and fire prevention codes than do the special provisions of the codes themselves. If you have an official with adequate technical background, he will see to it that the provisions of the present code are so enforced as not to work a hardship on the building industry, and he will see that the local building and fire prevention regulations are kept constantly up to date.

Doubling the present salaries paid the top fire prevention bureau and building department officials will have to be considered. Better pay for building and fire prevention officials would do more to reduce the cost of building construction than anything else. One unwise or unnecessary provision applied to a single large building, for example, might account for an outlay of money far in excess of the increased salary that might be paid to a better informed official.

Reliable Data on Materials

Fourth, persons who are attempting to meet the provisions of building codes and fire prevention codes have got to expect to furnish the enforcing officials with adequate information to enable them to make a proper decision with respect to any material or equipment that is proposed for use.

In the case of building materials, information should be furnished to the building department and the fire department with respect to the fire resistance ratings of structural assemblies which are proposed for the floors, walls and columns of buildings. For materials which involve a surface flamespread danger, such as wall finish materials, information should be furnished as to how such materials perform in the standard "tunnel" test.

On equipment proposed for use in buildings, reports of tests should be available in such form as to permit their use by the building department and fire department officials. In such matters, for example, as roofing materials, heating equipment, and fire protection devices, listings or approvals by Underwriters' Laboratories and other acceptable test agencies should be obtained.

National Standards

The activities of organizations like the National Fire Protection Association, which prepare standards which are accepted nationally, can be very helpful to manufacturers coming on the market with new products. Instead of attempting to sell the suitability of the product to every enforcing agency all over the country, a review of new material should be asked of the national organization. Proper reference to the material in the appropriate standard or committee report is likely to open the doors promptly to use of the material because of the already widespread use of these standards by enforcing officials.

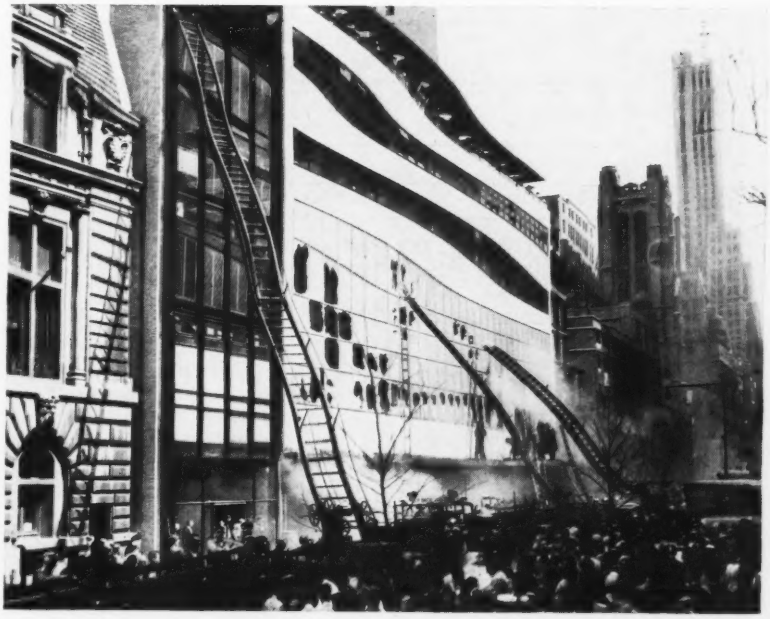
Manufacturers marketing new materials do not appreciate the extent to which local officials are willing to consider new materials and products. To pass on such materials and products, however, the official needs information so that he can decide what kind of recognition he can give them. The more information that the submitter can furnish, the better.

Much of the dissatisfaction with building codes, I am sure, stems from persons who have tried to hoodwink building officials and fire department officials. These officials, like anyone else, resent the insult to their intelligence of being given sales talk when what they want is appropriate information.

The New York Museum Fire

By Rexford Wilson, Engineer

NFPA Fire Record Department



United Press Photo

On April 15th in New York City a fire started on the second floor of the Museum of Modern Art. One life and two paintings were lost. Thirty-three persons were injured and seven paintings damaged. Property damage totalled close to $700,000.

The Museum Building

This 87 ft. by 126 ft., fire-resistive, 6-story building with mezzanine, basement, subbasement and penthouse was built as a museum in 1939 to house the then-scorned modern art. The plan for this museum was developed from an idea as new and novel to museum design as the art it was to house. The gallery floors were to be open in order to allow free arrangement of the exhibits. To achieve this effect the building was designed to have three high ceilinged, 87 ft. by 96 ft. gallery floors (see Figure 1) entirely open and unencumbered except for columns (see Figure 2).

The semi-portable, easily arranged, exhibit panels were constructed of materials familiar to the staff carpenters, namely, combustible hardboard on wood furring strips on wood studs. By making the panel walls flush with the columns (see Figure 2) the space between the panels could be utilized to

Based on a personal investigation by Mr. Wilson and information furnished by the Fire Department City of New York, New York Fire Patrol, New York Board of Fire Underwriters, the NFPA Committee on Libraries, Museums and Historic Buildings, and the members of the staff of the Museum of Modern Art.

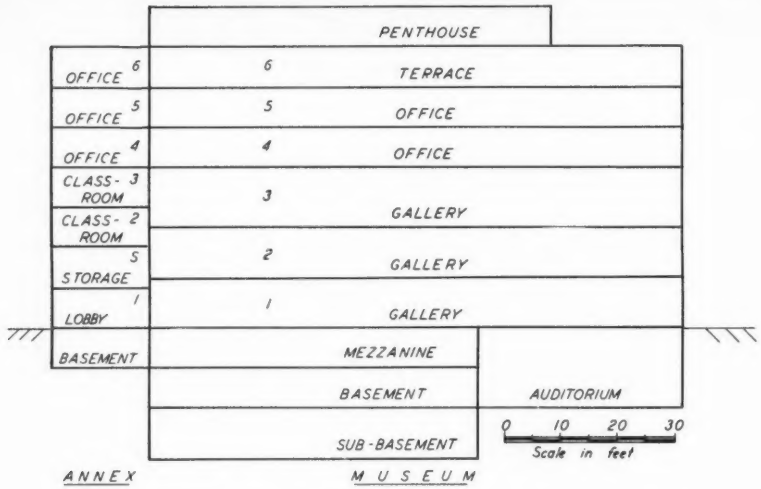


Figure 1. Elevation of the Museum of Modern Art and the adjoining Annex.

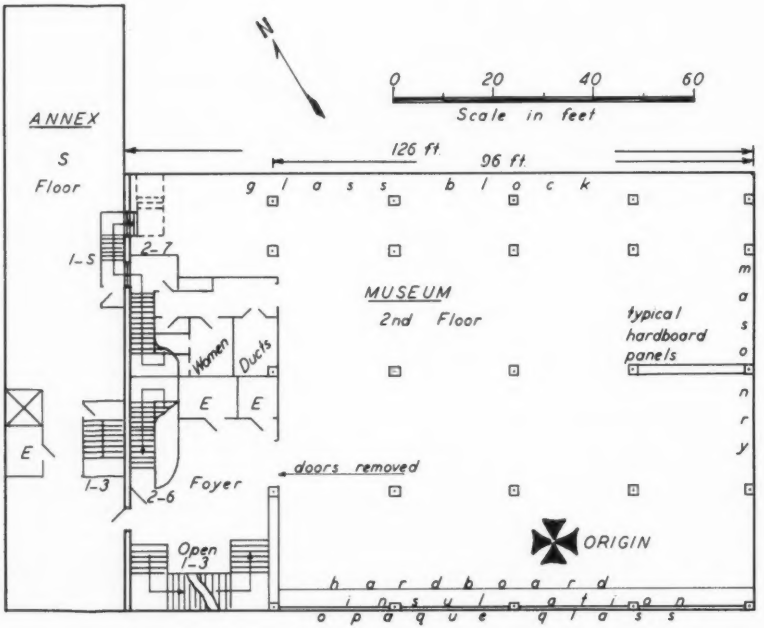


Figure 2. Second floor plan of the Museum of Modern Art and the S floor plan of the adjoining Annex. Note that the arrows on the stairwells point down the steps.

store the larger paintings which were slipped into this space through small doors in the panel ends. The increasing need for exhibit space resulted in a panel of the same combustible hardboard construction being built four feet inside the opaque glass, street-side, façade of the second and third floors. Behind this panel and close to the glass was hung a three-inch sheet of flameproofed fibrous insulating material (see Figure 2).

The rear wall of the second and third floors was glass block and the east and west side walls were masonry. This wall construction in addition to the glass, insulation, and hardboard front walls, made the second and third gallery floors difficult to ventilate in the event of fire and since these were in effect windowless walls, access by fire fighters was definitely hampered.

The subbasement was utilized for building equipment installations. The basement and mezannine housed a 48 ft. by 87 ft. auditorium, repair and production shops as well as limited exhibit space. The fourth and fifth floors were offices and the sixth floor was a roof terrace, restaurant and conference area. The penthouse contained more building equipment.

Stairways and Elevators

To avoid the clutter of stairways, elevators, air-conditioning ducts, plumbing and electric conduit in the exhibit areas all these services were located in the 30 ft. by 87 ft. bay at the west end of the building. In this service bay, aside from duct shafts, piping and conduit, were two elevators and three stairways. One elevator was a 7 ft. by 7 ft. passenger model, the other an 11 ft. by 7 ft. service model, both enclosed in masonry shafts with tight fitting metal doors.

The stairway arrangement was quite unusual. An open ornamental stairway ran along side the opaque glass front and connected the three gallery floors. A front stairwell, enclosed from the sixth to the second floor, discharged through a single door into the second floor foyer at the head of the open ornamental stairs leading to the first floor. This doorway was disguised on the foyer side to look like the wall and had hardware only on the stairwell side of the door so that entrance to this stairwell was impossible from the second floor foyer, if the door was shut. The second and third floor foyers were originally separated from the gallery by triple swinging doors which were removed (see Figure 2) as patronage of the Museum increased (50 on a good day in 1939, 5,000 in 1957).

The rear stairwell, unlike the other two described above, was similar, structurally, to the NFPA Building Exits Code requirements for a Class A two-unit exit. The lack of emergency lighting, proper exit marking, and panic hardware as well as inadequate exit width (a few doors, when opened, narrowed the exit path slightly) were the principal substandard features.

This rear stairwell ran from the penthouse to the ground floor where it discharged into the Sculpture Garden to the rear at grade level (see Figure 3). Both the front and rear stairwells were painted a dark battleship gray.

Private Protection

The building was equipped with two separate alarm systems, one a New York City required, manually operated, coded, fire alarm system which rang within the building only. The other, a security box emergency alarm system, located on the gallery floors, rang in a central station and called the police and fire departments. Boxes were located near the entrances to both stairwells at each floor. The alarm boxes on the gallery floors were recessed in deep wall niches and a door-like grill of four 1½-inch bars was placed over the front of the boxes. These bars were spaced about one inch apart and painted the same color as the wall in an attempt to disguise the fire alarm box appearance.

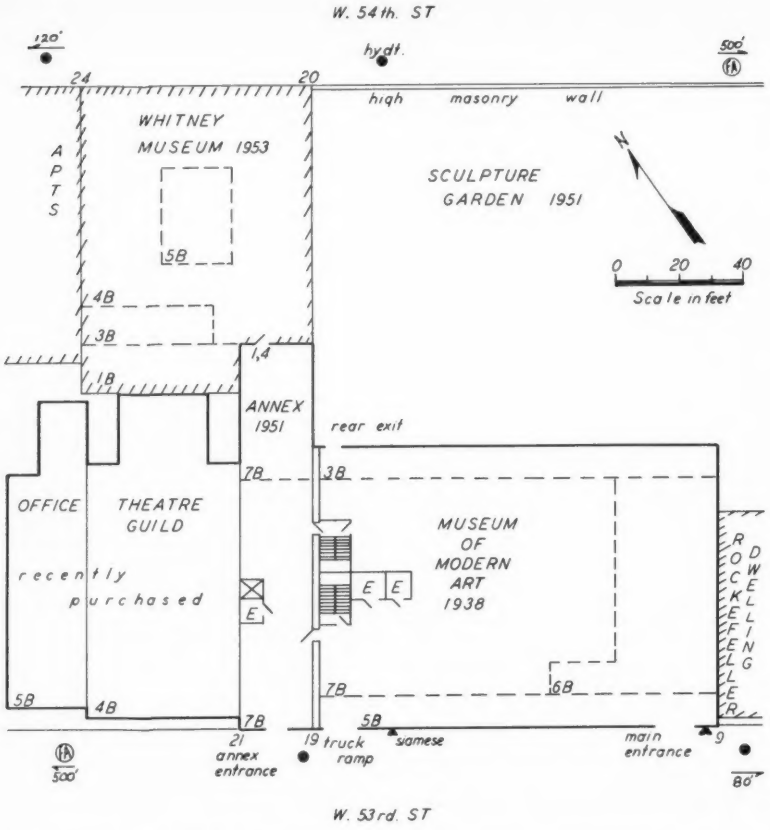


Figure 3. Plot plan of the Museum of Modern Art property and surrounding buildings. In the Museum and Annex, the stairwell and elevator arrangement shown here are for floors 4, 5, and 6 and the exterior wall openings for floor 1. Note also the doorway to the Whitney Museum on floors 1 and 4.

Although not a factor in this fire, this grill was so effective that it was not only difficult to see the boxes but hard to determine exactly what they were.

One of two standpipes supplied by a penthouse tank was located beside the rear stairwell. The other standpipe was located near the front stairwell. Two Siamese connections to the standpipe system were available in the front of the building.

The Annex

In 1951 a 23 ft. by 119 ft., fire-resistive, 7-story and basement Annex was constructed to the west of the museum (see Figure 3). This building, due to its normal ceiling heights (9½ ft.), was able to squeeze four floors into the same height as the Museum's three gallery floors (see Figure 1). In order to keep the upper three floors numbered the same as the Museum's fourth, fifth and sixth floors, the first four floors of

the Annex were numbered 1, S, 2, and 3; the S standing for Storage as the Museum's increasing collection of art objects was to be partially stored here. The top three floors were offices, the second and third floors classrooms and instruction areas.

All Annex floors communicated with the Museum's rear exit stairwell. There were no markings within the stairwell to indicate floor levels or directions to outside. Due to the difference in floor levels this stairwell had a door on five separate landings below the fourth floor. Passing unidentified doorways at different levels might understandably confuse persons using this stairwell as an emergency exit. The top three Annex floors and the S floor communicated directly with the Museum through doors in the fire wall near the front stairwell (see Figures 2 and 3).

A separate enclosed stairwell (opposite the elevator in Figure 2) connected the lower four Annex floors with the Annex lobby. This stairwell was close to the NFPA Building Exits Code requirements with the same reservations as previously mentioned regarding the rear Museum stairwell.

The Annex was equipped with a partial basement sprinkler system and fire alarm systems similar to those already described for the Museum.

The Surroundings

The Sculpture Garden to the north of the Museum was renovated and enlarged when the Annex was built. This attractive garden was separated from West 54th Street on the north side by a high masonry wall, and was beautified by trees, a terrace, a pool, flowers, and sculpture. It communicated directly with the Museum, the Annex, and the Whitney Museum of Art (see Figure 3).

The Whitney Museum was built about 1953. It is a 4-story fire-resistive museum with basement and penthouse. It communicated with the Annex on the first and fourth floors through fire doors installed in a sub-standard manner (lacking automatic closing apparatus).

The Rockefeller dwelling adjoined the Museum of Modern Art on the east.

The four story, basement and attic Theatre Guild building and the 5-story and basement brownstone office building to the west were recently purchased by the Museum.

The Renovation

The increasing public interest in modern art required improvements to smooth out traffic and building use problems. At the time of the fire renovation of the second floor was nearing completion and a $630,000 modernization of the air conditioning system was in progress.

In the service bay, openings had been made in all floors to receive new ducts. On the fifth floor the door to the rear stairwell was tied open as work was progressing in an adjoining space. The rear four-inch standpipe was disconnected on this floor. The fire department was notified of this standpipe work and white "out of service" disks had been attached to the Siamese connections. On the second floor both stairway doors were tied open and the duct shaft doors removed to facilitate the work. The old duct system was disconnected in places for interconnection with the new system. Welding new duct work in place had begun.

In the second floor gallery the paintings were removed to the Annex S floor except for nine large canvases which were too big or too delicate to be moved. Seven of these paintings were stored in the space between the second floor hardboard display panels (see Figure 2). The two remaining paintings were by Claude Monet and both were called "Water Lilies." The smaller, a nine-foot painting, was hung on the landing of the ornamental open stairway to the third floor and the other, an 18-foot painting, was left where it hung on the hardboard panel

Wide World

Two women who had become panic-stricken when smoke and heat spread up stairways were taken down fire department ladders from the fifth story of the Annex.

which had been placed in front of the opaque glass façade. To protect this painting from damage during renovation a separate hardboard enclosure had been built around it.

On the morning of Tuesday, April 15, the painters were midway through their job, the last stage of the second floor renovation. Wooden scaffolding had been erected and non-flameproof tarpaulins had been spread. Workers, who were allowed to smoke, started cleaning up the rubbish accumulations left from the alterations. At noon the painters went to lunch leaving 35 gallons of paint in open cans.

The Fire

Shortly after noon a plasterer returned to the second floor and found a small fire (thought to have been caused by a cigarette) in a tarpaulin near the open paint cans. He yelled for help and a guard responded. They tried to put out the fire with an extinguisher, but it was advancing rapidly. The paint in open cans caught quickly and then fire flashed over the newly painted panels. The wooden scaffolding and rubbish collections nearby added fuel to the flames. The paint and panelling gave off thick, black smoke. These acrid fumes had only one route off this floor, that was through the service bay. They boiled up the open ornamental stairway, through the tied-open doors to the stairwells, up the open duct shaft and into other openings for ducts, piping, and conduit. Someone pulled the building fire alarm and the central station alarm.

The Escape

The attendance was estimated to be over 500 at the time of the fire. This included 100 staff members, 60 contractors crew, 30 children aged three and one-half to ten years old taking lessons in the Annex classrooms, and visitors viewing the exhibits in the galleries and having luncheon on the sixth floor terrace.

As the local fire alarm sounded at 12:25 P.M., the 30 children were led down the Annex stairwell by their instructors. This is the only reported escape utilizing the stairs in a downward direction, indicating the rapidity with which this smoke and heat spread through the open stairwell doors. It is not known if the gray color of the stairwells made the smoke appear worse than it actually was. Approximately 50 people fled to the fourth floor of the Annex and escaped through the door to the Whitney Museum. Close to 200 people climbed up the stairwells to the sixth floor terrace. By this time the Fire Department and Fire Patrol were in the street. Fifteen people on the fifth floor of the Museum found their exit blocked by smoke. They were driven back toward the east end of the building. Fortunately, there was a high window on the southeast corner overlooking the roof of the Rockefeller dwelling. By climbing on a chair placed on a desk and smashing the glass they were able to crawl out through this window to the roof of the Rockefeller dwelling. They then helped twenty jittery people who dropped the short distance from the sixth floor terrace above. The other people on the terrace chose to remain and watch the fire fighting and rescue operations from their vantage point.

Panic

Only three people, all women visitors, were panicky. They were in the Annex and became excited as smoke poured from the air conditioning system. One of the three on the sixth floor is reported to have smashed a front window, cutting herself, and then dropped her belongings out. She was led to the elevator by a fire fighter and taken to safety. Two women on the fifth floor refused to leave with staff members, several of whom stayed behind, but even they subsequently had to leave by elevator when the smoke became so thick they feared for their own safety. Two panic-stricken women smashed a Museum officials' attaché case and a

telephone desk set in attempts to break the already open windows. Fire fighters removed them down an aerial ladder.

The Fire Fighting

Due to the difficult entry to the second floor and to the fact that the thick black smoke seemingly centered around the elevator shaft, the fire department assumed that the fire originated in the shaft. By 12:44 P.M. it was definitely determined that this was not the case and the second alarm was requested. Since there was another simultaneous working fire in this area of the city, the third alarm was rung by the dispatcher. This meant that ten engine companies, two ladders, one rescue company, one fire department ambulance, one fire patrol (insurance salvage) unit and five chiefs including the Commissioner and Chief of the Department were at the fire or on the way.

Five subsequent calls were made for: two ladders (12:46 P.M., 1:00 P.M.); six fire patrol units (3 — 1:40 P.M., 3 — 1:52 P.M.); and another department ambulance (2:07 P.M.).

During these calls a plumber ran from the building and mistakenly said that the standpipe had been repaired. The hoses were connected to the Siamese and the pump started. Water, pouring from the four-inch opening on the fifth floor, began cascading down the rear stairwell, and collecting on lower floors.

The fire fighters, moving as carefully as possible in the smoke-filled second floor, used six 2½-inch lines with spray tips in an effort to avoid damage. In order to ventilate the second and third floors the front opaque glass façade was broken. The fibrous insulation was ripped down and the hardboard panel pushed down with pike poles. The 18-foot Monet "Water Lilies," already damaged by fire, heat and smoke, was ruined by this action.

A man was found on the second floor face down in six inches of water by Rescue Company men. He was a Brooklyn father of three, who was working here as a contractor's electrician. It was reported that he voluntarily led the fire fighters to the second floor early in the fire. The clawed finger marks on the smoke-smudged wall were mute testimony that he lost his way in the dense smoke.

The fire was reported under control at 1:20 P.M.

The Salvage

The fire patrol crew with the quickly rallying employees went to work to save the exhibits. The first floor gallery exhibit of over 85 of the late Cubist painter, Juan Gris's works were moved to the Sculpture Garden.

The third floor gallery exhibit of over 150 works of the 19th Century French Pointillist Painter, Georges Seurat was moved to the Whitney Museum. This collection had been gathered from over 91 museums and collectors in nine different countries and included Seurat's famous "Sunday Afternoon on the Island of La Grande Jatte" valued at $1,000,000. This painting was on loan from the Chicago Art Institute for this show only. It could be lent just once by stipulation of the donor. This 500-pound masterpiece was removed from its frame, covered and carried to the Whitney Museum by a hastily assembled eleven-man task force.

The Museum's stored paintings were removed from the Annex S floor to the Annex lobby and later to the adjoining Theatre Guild Building. The closed door from the Annex to the second floor foyer was the only thing that protected this valuable permanent collection.

The Damage

One man dead, three women and 30 fire fighters injured, two paintings destroyed and seven damaged. The dollar loss has been reported as high as $300,000 for the building and $400,000 for the contents.

Sixty-two of the 155 glass panels in the building front were broken, the fibrous insulation removed and many of the hardboard panels destroyed. Structural damage was limited to the drop ceiling of the second story which will have to be replaced, and the decorative stairway which was damaged.

The following losses were sustained to the Museum's largest pictures:

1. Claude Monet "Water Lilies," 18-foot — destroyed. Hung on front panel.
2. Candido Portimari "Festival St. John's Eve" — destroyed. Stored between panels.
3. Claude Monet "Water Lilies," 9-foot — worst damaged, possibly destroyed. Hung in ornamental stairwell.
4. Larry Rivers "Washington Crossing the Delaware" — heavily damaged. Stored between panels.
5. Paul Tchelitchews "Hide and Seek" — heavily damaged. This painting was the Museum's most popular oil but had been stored between panels during the renovation.
6. Umberto Boccioni "The City Rises" — ⅓ possibly destroyed. Stored between panels. This painting was the most highly valued by the Museum.
7. Jackson Pollock "Number 1 — 1948" — Smoke discoloration of unprimed textile base. Stored between panels.
8. Jan Muller's "Faust 1" — right four inches possibly destroyed. Stored between panels.
9. Wilfredo Lam "The Jungle" — least affected, perhaps completely restorable. Stored between panels.

Though insured to 100 per cent of value the destroyed paintings will never more be visible, but through the efforts of talented and devoted men and women the others may regain something close to their original beauty. Where com-

United Press Photo

Larry Rivers' "Washington Crossing the Delaware" was heavily damaged. This painting was stored between panels on the second floor of the Museum.

plete restoration is not practical the paintings will be restored as closely as possible and appropriate identification made so they will still be available for study purposes.

The basement photographic display of "70 Photographers Look at New York, 1953 – 1957" did not "suffer extensive damage." Smoke damage was sustained to various other art objects and paintings throughout the building.

The Lessons

The lessons relearned from this fire range from gross infractions of sensible fire safety, like grouped fire exits, to smaller items such as the use of nonflameproof tarpaulins.

The philosophy of museum fire safety is as direct and obvious as any in fire protection. The first rule is life safety. Therefore, adequate smoke and fire-resistive exits should be built in conformance with the NFPA Building Exits Code to insure the unhampered escape of both visitors and employees. The second rule is the absolute protection of the exhibits. These exhibits, unlike the products of a manufacturing concern, cannot be replaced. They must be protected.

Some fire *causes* can be removed, others cannot, but all chance for fire *spread* can be eliminated. Fire cannot spread over noncombustible materials, therefore, these materials should be used in all parts of the building. Where fabrics are used, such as curtains, tapestries, tarpaulins, they should be treated with standard flameproofing solutions or be of noncombustible material (glass, etc.). Vertical openings in floors should be avoided and horizontal cutoffs for fire should be provided and maintained. Reconstruction, renovation and remodelling introduce many extra fire hazards and building owners should recognize these hazards and take appropriate action to protect their properties accordingly.

The fire protection lessons relearned from this fire which apply to all museums are:

1. Since life safety is the principal factor the museum should conform on all counts to the NFPA Building Exits Code.

2. The museum should be completely sprinklered.

3. All stairway, elevator and fire doors should be kept closed.

4. All combustible material within the museum should be kept to a minimum.

5. Separately constructed, properly protected, cut-off storage areas should be provided which will store any art objects not on exhibit.

6. Smoke detection equipment to shut down air conditioning systems in the building is recommended where the panic hazard may be pronounced or where the contents may be smoke damaged. (See NFPA Standard No. 90A.)

7. A capable person should be placed in charge of all fire protection for the building.

8. Fire drills should be held at frequent intervals. Some person should be delegated to see that all fire doors are closed.

9. During construction or renovation: (see NFPA Standard No. 241) the following essentials apply:

a. Areas under renovation should be closed off from the rest of the building.

b. All exhibits should be removed from the area involved.

c. Extra extinguishers, hose lines, and a fire watchman should be provided.

d. All fire protection equipment such as standpipes and sprinkler system should be in full operating order or where a small section is out of order

temporary connections, plugs, or bypasses should be installed to maintain as much service as possible.

e. All guards, employees and construction people should understand that the fire alarm is to be given first and the fire fought second or simultaneously with the help on hand.

f. Smoking, welding and cutting, and other similar hazardous operations should be limited to safe areas under proper supervision.

NFPA Committee Activity

Society's trust in museum officials for the protection of art and historic objects must be fully accepted by these officials and the hazards that threaten to destroy these objects understood in order that absolute protection be planned, incorporated, and maintained.

The NFPA Committee on Libraries, Museums and Historic Buildings stands ready to help any museum protect this trust at no cost to the museum.

Reviews and Abstracts of Technical Papers

It is NFPA policy to publish in the QUARTERLY significant technical papers which are available dealing with fire subjects. For various reasons many valuable papers cannot be published in full. This department is to review or abstract some papers which otherwise might not be available to readers.

NPFA members are often advised in FIRE NEWS about papers which appear in a publication which can be readily obtained by purchase. Publications listed in FIRE NEWS would not necessarily also be listed in this department.

Members are invited to submit reviews of abstracts of papers which merit mention here. Where possible a copy of the original paper should accompany the review or abstract. Minimum information address of publisher, date, number of pages and price (if one is stated).

Some papers reviewed or abstracted will be from periodicals which are often available only on a subscription basis. In some cases only limited copies of particular papers may be available. The review or abstract, however, may enable members interested to secure copies which will be in the files of various libraries. Most authors would try to furnish copies to other technical people working in the same area, and arrangements can sometimes be made to obtain copies from the source mentioned or on a loan basis. The NFPA library will usually have copies on file but will not be able to lend library file copies.

Research on Explosion- and Fire-Suppression Systems Utilizing a Visual Type Detector. By Bradford T. Joyce, Electronics Corporation of America. This report, identified as WADC Technical Report 55-405, has been published by the Wright Air Development Center, Air Research and Development Command, United States Air Force, and qualified persons may obtain copies of the report from the ASTIA Document Service Center, Knott Building, Dayton 2, Ohio.

The report gives test data on work conducted by the Electronics Corporation of America in the use of explosion and fire extinguishing systems using a radiation-sensitive detector developed by the company. The tests concern the

material, shape and size of the extinguishant capsule and the effect of these factors on the dispersal of the extinguishing medium. The effect of the detonator material and the strength of the charge on the dispersal of the extinguishing agents was also studied and the patterns obtained with chlorobromomethane and dibromodifluoromethane were analyzed as well as evaluated for their fire and explosion effectiveness (see also Report identified as WADC Technical Report 57-156, abstract given below).

Explosion-Suppression System Development Test Program. By Electronics Corporation of America. Published as WADC Technical Report 57-156 by the Wright Air Development Center, Air Research and Development Command, United States Air Force, and qualified persons may obtain copies of the report from the ASTIA Document Service Center, Knott Building, Dayton 2, Ohio.

This report carries on with the research reported in WADC Technical Report 55-405 (see abstract above) for the purpose of studying further the parameters involved and more detailed testing of detection time and range using various combinations of tank sizes, fuel/air ratio, extinguishing agent and capsules. Gunfire-suppression tests were carried out under this program and proved the effectiveness of the system and provided data on the amount and distribution of extinguishants for different tank sizes ranging from 30 to 3,000 gallons. The report urges that more precise studies be made on the application of these systems to aircraft and methods by which reduction in the weight of such explosion suppression systems might be accomplished.

Theoretical and Experimental Observations of Static Electricity in Petroleum Products. By D. T. Rogers, J. P. McDermott and J. C. Munday, Products Research Division, Esso Research and Engineering Company, Linden, N. J. This paper is published by the American Petroleum Institute, 50 West 50th Street, New York, New York and is based on a paper presented at the Division of Refining Session, 37th Annual Meeting of the API held in Chicago, November 12, 1957.

The production of static electricity in liquid hydrocarbon fuels is associated with the presence of colloidal contaminants which ionize in the hydrocarbon environment. The contaminants are largely organic in nature and represent fuel degradation and oxidation products or residues from treating operations. They are only partially removed by ultra-filtration, but can be almost completely removed by adsorption on silica gel or activated clay.

The electrical potency of fuels is markedly increased by exposure to elevated temperatures, ultraviolet or gamma radiation, or by the addition of contaminants such as asphalt.

The rate of charge production increases with flow rate and is accelerated by small amounts of water, air, and dispersed solids. The effect of temperature is variable. Raising the temperature in the range of 50°F to 105°F reduces static production with some fuels, but increases it with others. The nature and condition of the charge-separating surface are of importance also.

The discharge of static electricity as visible sparks from the surface of hydrocarbons takes place most readily at points of high curvature, and the potential at which it takes place decreases with increasing conductivity. With some commercial fuels, discharges take place within the liquid phase at potentials not greatly different from those for air. Under some laboratory conditions static production is so intensive that discharges occur in the liquid, and in the presence of air these could lead to submerged explosions.

The production of electrostatic charges by hydrocarbon mists and fogs is under study.

Antistatic additives have been found which, in low concentrations (0.005 per cent), generally reduce static production

to low levels in laboratory tests. Under some conditions much higher concentrations may be required. The use of additives may be limited to systems where the electricity is produced in, and discharged from, the liquid hydrocarbon.

The Use of Radioactive Material to Reduce Static Electricity Inside Storage Tanks. By J. J. Conradi, J. R. Miller and J. J. Skelly, Research Laboratory, Shell Oil Company, Wood River, Illinois. This paper was presented at the American Petroleum Institute's Division of Refining Session, 37th Annual Meeting of the API held in Chicago, November 12, 1957. The paper was printed by the American Petroleum Institute, 50 West 50th Street, New York, New York.

Development of electrostatic charges in tanks and vessels in which hydrocarbons are pumped initiated research into the efficacy of a radioactive source in reducing this hazard. The radioactive source functions by ionizing the vapor space thereby producing a conductive path through which the charge on the hydrocarbon surface can be dissipated. Experiments to date, reported in this progress report by the authors, were carried out in a typical cone-roof blending and storage tank containing straight-run mineral spirits and using a 100-millicurie strontium 90-yttrium 90 beta-ray source. Charging was accomplished by stirring the hydrocarbon with a mixer. The effect of the source upon the surface charge of the hydrocarbon is deduced from electric-field-strength measurements. The use of radioisotopes to dissipate electrostatic charges during the handling of hydrocarbons appears to be practical in small-tank applications.

General Considerations of Static Electricity in Petroleum Products. By W. M. Bustin, T. L. Culbertson, C. E. Schleckser, Jr., Esso Research and Engineering Company, Linden, N. J. This paper is published by the American Petroleum Institute, 50 West 50th Street, New York City, New York and is based on a paper presented by the authors at the Division of Refining Session of the 37th Annual Meeting of the API held in Chicago, Illinois, November 12, 1957.

Static electricity which is generated by hydrocarbons during normal operations occasionally causes a spark in a tank vapor space. During the past 10 years, 18 fires in the Standard Oil Company (New Jersey) have been attributed to static electricity. Current safety measures include low pumping rates, avoidance of surface agitation and water, and use of floating-roof tanks to eliminate the vapor space. Tanker compartments are gas-freed when necessary. Carbon dioxide gas blanketing is planned for some barge operations.

Experimental work has confirmed that electrical current generated in pipeline flow is given by:

$$I = (TKV^{1.75})\left(1 - \epsilon^{\frac{-L}{TV}}\right)$$

Where:

I = current issuing from line with fuel.

T = fuel time constant.

K = factor determined by pipe diameter and fuel-pipe interface.

V = velocity.

ϵ = base of Napierian logarithms.

L = pipe length.

As suggested by this formula, an enlarged pipe section allowing low velocity for a short period of time will materially reduce the static charge. Filters of the type to be used in aircraft loading systems generate substantial charge in the fuel which can be reduced by a downstream tank of practical dimensions.

A probe for quantitative measurement of electrostatic fields with minimum field distortion has been developed. This probe will be used to explore electrostatic fields in a 10,000 gallon tank arranged for large-scale static-electricity studies.

Tests have shown gaseous carbon dioxide blanketing to be effective and practical in preventing explosive vapors.

Index To Advertisers—July 1958

	Page
Aer-Vent Service	A24
American District Telegraph Company (ADT)	A1
Ansul Chemical Company	A9
"Automatic" Sprinkler Corporation of America	A32
Blaw-Knox Company, Sprinkler Division	A25
Cardox Corporation	*Inside Front Cover*
Central Station Electrical Protection Association	A10
Central Station Signals, Inc.	A8
Chicago Bridge & Iron Company	A14
Fyr-Fyter Company	A17
Gamewell Company	*Inside Back Cover*
Grinnell Company, Inc.	*Back Cover*
Gustin-Bacon Manufacturing Company	A21
Walter Kidde & Company, Inc.	A19
Kinnear Manufacturing Company	A6
Lexsuco, Incorporated	A31
M & H Valve & Fittings Company	A30
R. C. Mahon Company	A12
Minneapolis-Honeywell Regulator Company	A3
National Fire Protection Association	A28
National Foam System, Inc.	A15
Notifier Corporation	A7
Pyrotronics, Division of Baker Industries, Inc.	A29
Raisler Corporation, Raisler Sprinkler Division	A26
Reeve Electrical Company, Inc.	A4
Reliable Automatic Sprinkler Company	A13
Rockwood Sprinkler Company	A5
Star Sprinkler Corporation	A20
Tokheim Corporation, General Products Division	A18
Van Loon Industries	A2
Van-Packer Company, Division of The Flintkote Company	A11
Vapor Recovery Systems Company	A22
Victaulic Company of America	A16
Viking Corporation	A23
Wm. Wallace Company, Metalbestos Division	A27

Our warehouses have had constant ADT Protection since 1900. The satisfaction we have experienced cannot be measured in dollars and cents, yet these services are more economical than less effective methods. We estimate our savings at $6,500 a year.

W. H. [illegible] PRESIDENT

LOUISVILLE PUBLIC WAREHOUSE COMPANY
LOUISVILLE, KY.

protects its property *Automatically*
gets better FIRE and BURGLARY protection
saves $6,500 a year

Maximum security for the millions of dollars' worth of customers' merchandise stored in the extensive Louisville warehouses, covering more than 396,500 square feet of floor space, is assured by a combination of ADT Central Station Sprinkler Supervisory, Waterflow Alarm, and Burglar Alarm Services.

Water supplies to the automatic sprinkler system, including the 100,000-gallon standby tank, are under constant electrical supervision. In case of fire, fire-fighting forces are called *automatically*. Every door, window and skylight is ADT-protected to summon police *automatically* if burglars attack.

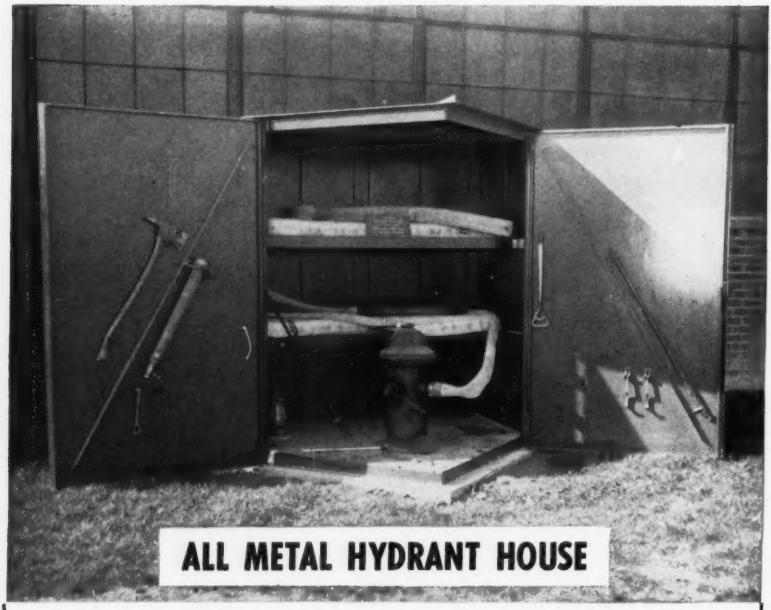
Thousands of warehousemen and other businessmen from coast to coast use and endorse ADT *Automatic* Protection Service because they know that it gives greater security for property, profits, customers' goods and employees' jobs than can be obtained otherwise, and at less expense.

May we show you what ADT can do for you?

Whether your premises are old or new, sprinklered or unsprinklered, an ADT specialist will show you how combinations of automatic services can protect your property. Call our local sales office, or write to our executive office.

ADT

AMERICAN DISTRICT TELEGRAPH COMPANY
A NATIONWIDE ORGANIZATION
Executive Office: 155 Sixth Avenue, New York 13, N. Y.



— FACTORY MUTUALS APPROVED —

Many Architects and Engineers are specifying the Model 60 ALL-STEEL Hydrant House on new jobs and recommend their use for replacement of existing wooden houses as they wear out.

The advantage of a Hydrant House is that it protects the hose and hydrant during inclement weather when sleet or snow cause heavy icing. The hose is coupled and ready at any hour of the day or night. All steel houses are weathertight and rat proof — will not warp or dry out. Eight (8) Louvers are stamped in side panels for ventilation.

Doors are formed of 16 gauge metal. Roofs and side panels are 20 gauge. Shelves are perforated and formed of 14 gauge. Corner supports and hinge posts are formed of 12 gauge. Finished weight — 600 lbs.

Houses are shipped from stock, knocked down. Roof, base, shelves, doors and panels are completely prefabricated of **galvanized iron with zinc plated hardware. Hinges are brass pinned.** Two men with only a screwdriver and a wrench can erect it on foundations in less than one hour.

Manufactured by

VAN LOON INDUSTRIES

ENGINEERS AND FABRICATORS

3409 East McNichols Road Detroit 12, Michigan

TWinbrook 3-4460 TWinbrook 3-4461

CUSTOM HOSE CABINETS MADE TO YOUR SPECIFICATIONS

Now a new automatic Fire Alarm system with permanent reliable service from Honeywell

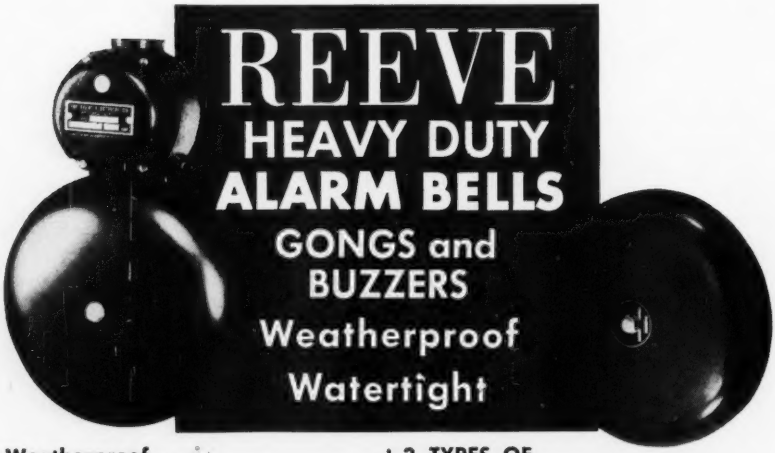
HONEYWELL'S Fire Detection System positively locates fires, speeds action to keep damage down! It offers these unique features—

- Positively locates fire by numbered lights—not necessary to count bell strokes to identify zone.
- More dependable—transmits alarm even with a ground or break in detection circuit.
- Stand-by battery provides protection even when power fails.
- Ideally adapted to automatic reporting of fires both to building supervisor's office and to nearest fire station.

This new system is backed up completely by Honeywell. Your nearest of 112 Honeywell Sales Offices provides fast local application information plus 1 year free service. After that, reliable Honeywell service is still readily available. And if you wish, you may contract with Honeywell for periodic inspection or complete maintenance. For further information call your Honeywell Office or write Minneapolis Honeywell Regulator Co., Dept. QN-7-125, Minneapolis 8, Minnesota.

Honeywell

H HONEYWELL First in Control



REEVE
HEAVY DUTY ALARM BELLS
GONGS and BUZZERS
Weatherproof Watertight

Weatherproof —
Sizes 3", 4", 6", 8", 10", 12"
DC—6—220 V. · AC—12—220 V.

Watertight —
Sizes 3", 4", 6", 8", 10", 12"
DC—6—220 Volt · AC—12—220 Volt
60 Cycles, 110—220 Volt, 25 Cycles

3 TYPES OF
UNDERDOME BELLS
OPEN PIGTAIL · WEATHERPROOF · E-Z MOUNT
Sizes 6", 8", 10". Cast aluminum housing
Hot Pressed Steel Gong Shell
Single Stroke and Vibrating Types
Voltages are the same as Neck Type

Special Windings on request.

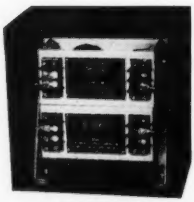
Seal of approval by UNDERWRITERS' LABORATORIES · FACTORY MUTUAL LABORATORY, INC. · UNITED STATES COAST GUARD

Write for Catalog Material and Prices!

AUTOMATIC BATTERY CHARGER, High and Low Current

The unit is designed for use on any storage batteries not subject to heavy drains. It will trickle charge the battery indefinitely because of its automatically decreasing rate of charge.

For use with six cells (12 volts). Automatically controlled by saturable reactor. Continuous output one ampere. 22.5 watts, 118 volts, 60 cycles. 3% Regulation. 9" x 9" x 6" — 14 B & S gauge steel wall cabinet. 15¼ lbs. U.L. Approved. No moving parts.



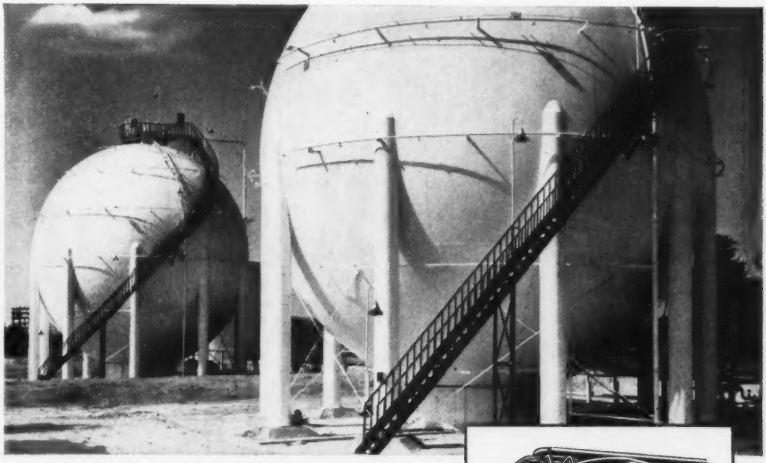
MODEL BC-12

Manufacturers of a complete line of

CENTRAL OFFICE and LOCAL FIRE ALARM DEVICES

· automatic alarm devices · sprinkler alarm and supervisory devices · burglar alarm devices and accessories. DYNALARM (sound detection for both reverberant and non-reverberant vaults).

THE REEVE ELECTRICAL CO., Inc.
120 West 42nd Street, New York 36, N.Y.



These two 55′ diameter spherical tanks contain butadiene. Each sphere is protected by two automatically operated Dualguard Deluge WaterFOG Systems. These systems are designed to protect spheres from damage by fires in the sphere area . . . control fires . . . and to accelerate dissipation of flammable vapors in the event of a spill. Rockwood heat activated devices stand as sentinels in the Dualguard Deluge System.

No Balls of Fire Here!

Rockwood Dualguard Deluge Systems protect these butadiene filled tanks from fire. The system gives all the advantages of Rockwood WaterFOG plus the added feature of a *Rate-of-Rise* Heat detecting system.

And when you combine this remarkable *Rate-of-Rise* system with Rockwood WaterFOG you get protection that's unmatched.

Rockwood WaterFOG shuts off oxygen, confines and controls flammable liquid fires — *fast.*

We don't have enough room on this page to tell you all the advantages of the Rockwood Dualguard Deluge Systems — so fill in the coupon below and we'll send you full information.

ROCKWOOD SPRINKLER COMPANY

Engineers Water . . . to Cut Losses

Distributors in all principal industrial cities

ROCKWOOD

ROCKWOOD SPRINKLER COMPANY
2471 Harlow Street
Worcester 5, Massachusetts

Please send me your illustrated booklet on the Dualguard System.

Name.....

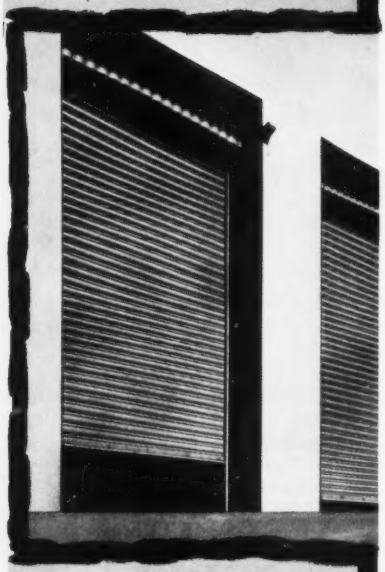
Title.....

Company.....

Street.....

City.....*Zone*..*State*.....

3-HOUR
Class A Label
of the Underwriters' Laboratories, Inc.
is carried on AKBAR Doors
for ALL Installations* in
interior
Fire Walls, Corridor and Room
Partitions and Vertical Shaft Openings



1½-HOUR
Class D Label
of the Underwriters' Laboratories, Inc.
is carried on AKBAR Doors
for ALL Installations* in
exterior
Wall Openings

Automatic Closure in case of FIRE

Kinnear
exclusive
AKBAR
STEEL ROLLING FIRE DOORS

*"Akbar Fire Doors" for openings up to 120 sq. ft., but not exceeding 12′ in width, or height, bear the label of the Underwriters' Laboratories, Inc. Doors for large openings will be furnished and upon request the Underwriters' Laboratories will furnish certificate of inspection, for doors covering openings not exceeding 24′ in either width or height, indicating that their construction conforms to the requirements of the Laboratories.

The KINNEAR Mfg. Co.
FACTORIES:
2250-70 Fields Avenue, Columbus 16, Ohio
1742 Yosemite Ave., San Francisco 24, Calif.
Offices and Agents in All Principal Cities

KINNEAR ROLLING DOORS
Saving Ways in Doorways

MISSILE AGE EQUIPMENT CAN PREVENT DISASTROUS FIRES

For Plant Fire and Security Protection Industry looks to

NOTIFIER

"THE LEADER"

FOR
- **Quality Equipment**
- **New Ideas**
- **Modern Developments**

Such as replacement of 19th century code wheels with modern plug-in electronic equipment.

Fast as the speed of light

Notifier engineers will help you solve your fire and security protection problems. No job too small, no layout too big or complicated. Why not send us your prints? Just write - - - we'll be glad to tell you more.

*** See Directory of Products for our fire equipment listings.**

NOTIFIER CORPORATION
Lincoln, Nebraska

Notifier's nationwide organization offers exceptional opportunity for sales engineers trained in fire protection, municipal fire alarms, or electronics, and experienced in dealing with executives at top level. Dealerships open to substantial companies willing to set up independent sales and service department with capital and manpower adequate for handling large installations running into high five figures.

NOTIFIER CORPORATION
239 South 11th Street
Lincoln, Nebraska

Name ..... Position .....

Firm .....

Address .....

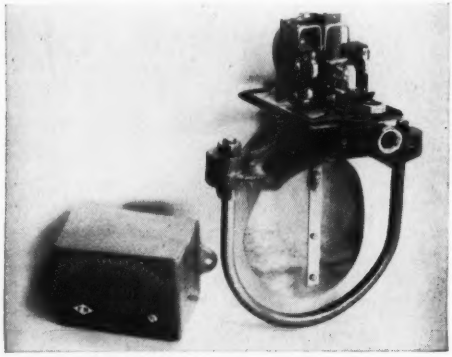
City ..... State .....

Mail this coupon today for informative bulletin on business opportunities with Notifier.

CENTRAL STATION SIGNALS, INC.

Manufacturers of all kinds of approved devices used in Central Station System or Class 'A' or Class 'B' Proprietary Fire Alarm Systems, either automatic or manual.

53 WEST 23rd STREET . . . . . NEW YORK 10, N. Y.



Model PRS-1

Sprinkler Waterflow Alarm

This device is approved by Factory Mutual Laboratories and Underwriters' Laboratories, Inc.

- This device is also made as Model PRT-1, a coded waterflow transmitter.

5-inch size shown above. To install simply drill 2-inch hole in pipe.

- Also made in explosion proof models.
- Made in all sizes from 2½" to 8".
- Has instantly recycling pneumatic retarding device, preventing false alarms.
- Has enclosed electrical contacts for any voltage not exceeding 15 amp. 125 volts, A.C. and ½ amp. 125 volts, D.C. Operates on all water pressures or surges.

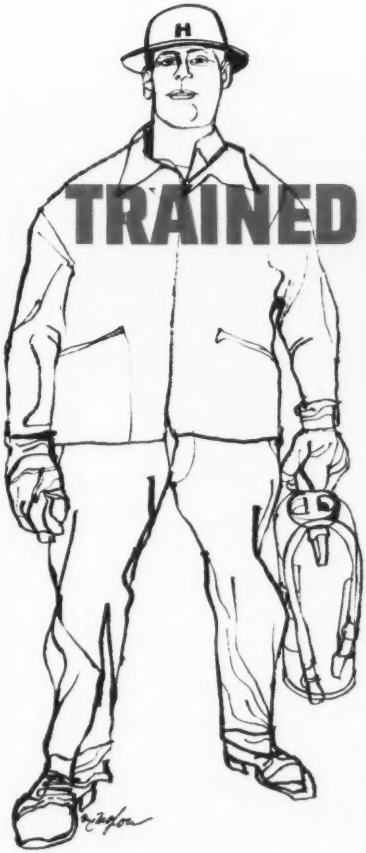
Size is 1⅝" x ⅝"

Tempo-Set Model A Fire Detector

Underwriters' Laboratories, Inc. Approved.

- Self restoring and can be heat tested.
- Electrical contacts are silver or gold and are enclosed.
- Very reasonable price.

- Tempo-set Model A is approved in either open or closed circuit and the temperature ratings are 135 and 200 degrees.
- Approved maximum distance between thermostats on smooth ceilings: 20 feet.
- Electric ratings are 125 volts 1 ampere, A.C. or 24 volts 0.5 ampere D.C. or less.



IN FIRE EMERGENCIES

TRAINED PEOPLE MAKE THE DIFFERENCE

Training your people is one of Ansul's most important jobs. In your own plant, at our Fire School in Marinette, Ansul experts instruct your men in the latest fire fighting techniques. This training is only part of Ansul's unique service program. In addition, you receive thorough fire protection surveys of your plant, visual aids to make your employees fire-prevention conscious. Trained men, fire prevention planning—plus Ansul fire extinguishing equipment give you the complete protection you need. Write us. Let us tell you about the Ansul service plan.

ANSUL CHEMICAL COMPANY / MARINETTE, WISCONSIN

FIRE EXTINGUISHING EQUIPMENT / INDUSTRIAL CHEMICALS / REFRIGERATION PRODUCTS / NATIONAL DISTRIBUTORS OF "FREON" REFRIGERANTS

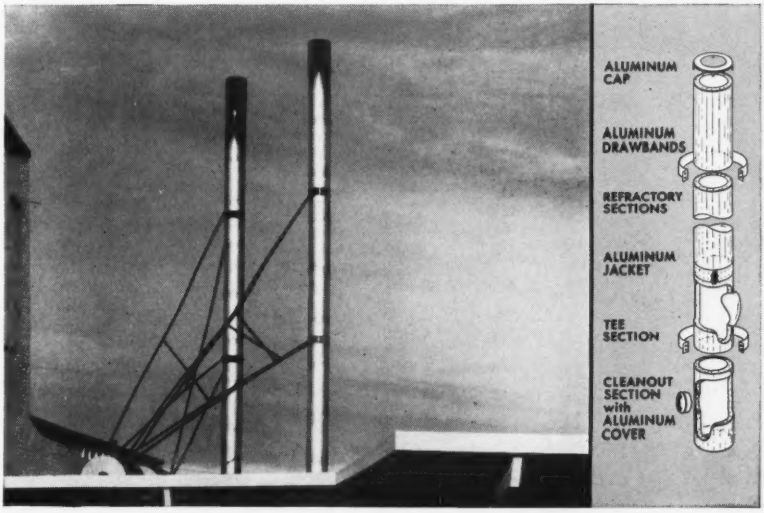
Nation Wide
Central Station Protection Services

Sprinkler Valve Alarm — Complete Sprinkler Supervisory — Manual Fire Alarm — Automatic Fire Alarm — Temperature Alarm — Oil Burner Supervision — Burglar Alarm — Hold-Up Alarm — Vault & Safe Protection

Available from these members of

Central Station Electrical Protection Association

ALBANY, NEW YORK	**ALBANY PROTECTIVE SERVICE** 99 Jay Street
BOSTON, MASS.	**CALL'S POLICE SIGNAL CORP.** 69 Washington Avenue, Chelsea
CHICAGO, ILLINOIS	**CENTRAL WATCH SERVICE** 214 West Ohio Street
CLEVELAND, OHIO	**MORSE SIGNAL DEVICES** 6707 Carnegie Avenue
DALLAS, TEXAS	**SMITH DETECTIVE AGENCY & NIGHTWATCH SERVICE, INC.** 610 N. Akard Street
DENVER, COLORADO	**DENVER BURGLAR ALARM COMPANY, INC.** 422-21st Street
DETROIT, MICHIGAN	**MICHIGAN STILL ALARM CO.** 10420 W. Chicago
HOUSTON, TEXAS	**McCANE-SONDOCK DETECTIVE AGENCY** 1612 Austin Street
LOS ANGELES, CALIF.	**MORSE SIGNAL DEVICES OF CALIFORNIA** 211 So. LaBrea Avenue
MANCHESTER, N. H.	**GRANITE STATE ALARM CO.** 839 Elm Street
MILWAUKEE, WIS.	**MERCHANTS POLICE SIGNAL & ALARM CO.** 429 W. Michigan Street
NEWARK, NEW JERSEY	**NEWARK DISTRICT TELEGRAPH CO.** 372 Plane Street
NEW YORK, NEW YORK	**CENTRAL STATION SIGNALS, INC.** 53 West 23rd Street
PEORIA, ILLINOIS	**OBERLANDER PROTECTION ALARMS** 725 West Main Street
PHILADELPHIA, PENNA.	**OWL PROTECTIVE CO., INC.** 120 No. Camac Street
ST. LOUIS, MISSOURI	**POTTER ELECTRIC SIGNAL & MFG. CO., INC.** 1211 Pine Street
SAN FRANCISCO, CALIF.	**AMERICAN BURGLAR ALARM COMPANY, DIVISION OF THE PACIFIC FIRE EXTINGUISHER COMPANY** 165 Jessie Street
WASHINGTON, D. C.	**FEDERAL ENGINEERING CO., INC.** 1004 Sixth Street, N.W.



New prefabricated refractory smokestack is safe, permanent

Permanence — The Van-Packer Industrial Stack is made of 3-foot long, non-corroding refractory sections cemented together with acidproof cement and secured with aluminum joint bands. Sections have maintenance-free aluminum jacket.

Safe — Van-Packer Standard Stack, for boilers and furnaces, withstands flue gas temperatures to 800° F. Van-Packer Hi-Temp Stack, for incinerators, withstands 2000° F., continuous exposure. Safe for all fuels.

High draft — Insulating qualities of refractory wall prevent heat loss, give draft equal to a brick stack, greater than a steel stack. Seven diameters from 10 inches I.D. to 30 inches I.D. Wall thickness varies from 2 to 3½ inches depending on diameter.

Tested and proved — Write for 32-page report of test data from independent laboratories, and Bulletin IS-32 with complete product information and specifications.

Van-Packer PREFABRICATED REFRACTORY **Stack**

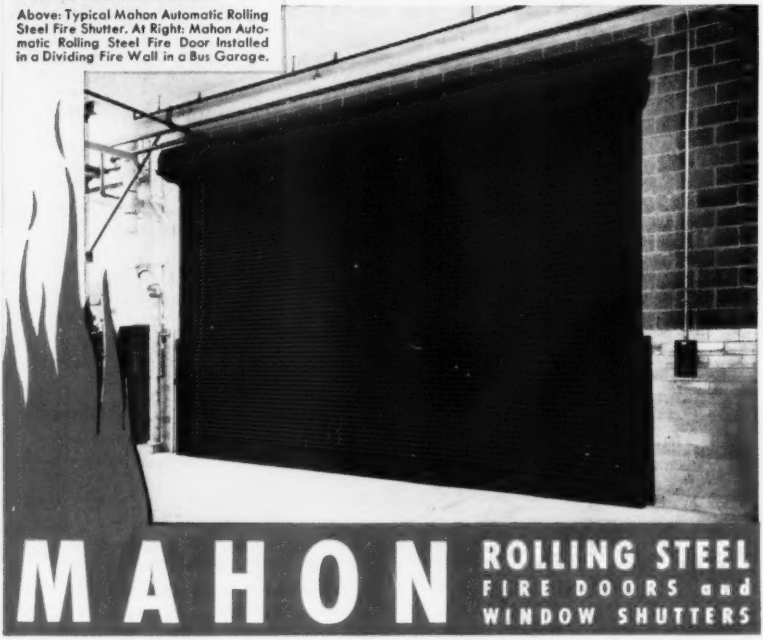
Van-Packer Company • Division of the Flintkote Company
P.O. Box No. 306 • Bettendorf, Iowa • Phone: East Moline, Ill. 3-5288

Automatic Rolling Steel
FIRE DOORS *and* WINDOW SHUTTERS
PREVENT SPREAD *of* FIRE!

You need good automatic fire doors in fire walls, corridors, and vertical shafts . . . in some cases automatic rolling steel window shutters are necessary to protect your building and its contents from fires which may originate in nearby buildings. Many, many cases are on file which confirm that timely action of automatic rolling steel fire doors and window shutters have confined a fire to its point of origin and permitted its being extinguished with comparatively small damage. Make a survey of your building now, and don't delay action. You will find a Mahon Automatic Rolling Steel Fire Door or Window Shutter to meet each of your requirements—all bear the Underwriters' Label. These automatic fire doors may be operated manually or mechanically in every day use. If a fire should break out while they are in the open position, the automatic mechanism will close the door, cutting off drafts and preventing the spread of the fire. See Sweet's Files for complete information, or write for Catalog G-58.

THE R. C. MAHON COMPANY • Detroit 34, Michigan
Branch Offices in New York and Chicago • Representatives in Principal Cities
Manufacturers of Standard and Underwriters' Labeled Automatic Rolling Steel Fire Doors and Window Shutters; Underwriters' Rated Metalclad Fire Walls; Insulated Metal Curtain Walls; Electrified M-Floors; Steel Roof Deck; Acoustical Long Span M-Decks; and Acoustical and Troffer Forms.

Above: Typical Mahon Automatic Rolling Steel Fire Shutter. At Right: Mahon Automatic Rolling Steel Fire Door Installed in a Dividing Fire Wall in a Bus Garage.



MAHON ROLLING STEEL FIRE DOORS and WINDOW SHUTTERS

IN ALL ITS **RELIABILITY!**

Every minute of the day and night, Reliable automatic sprinklers are acting as miniature fire control teams . . . standing ready to automatically detect, sound the alarm, and extinguish fires in their incipient stages.

This is the kind of Fire Control that is absolutely RELIABLE! For over thirty-five years, Reliable Automatic Sprinklers have been guarding life and property from threat of fire . . . without one report of failure.

The complete Reliable Line offers a wide selection of automatic sprinkler devices for every condition . . . including Spray, Sidewall, Conventional and Open Sprinklers; Alarm Valves; Dry Pipe Valves; Accelerators; Mechanical and Electric Alarms; and a full line of sprinkler accessories.

For perfect FIRE CONTROL . . . Let your local Reliable Licensee show you the RELIABLE FIRE CONTROL TEAM . . . We'll see that he contacts you promptly.

Licensees in principal cities of the U.S.,
Canada, and foreign countries.

Manufactured and Distributed by

THE **R** ELIABLE AUTOMATIC SPRINKLER CO. INC.

[illegible] STREET, MOUNT VERNON, N. Y.

Chicago Bridge & Iron Company

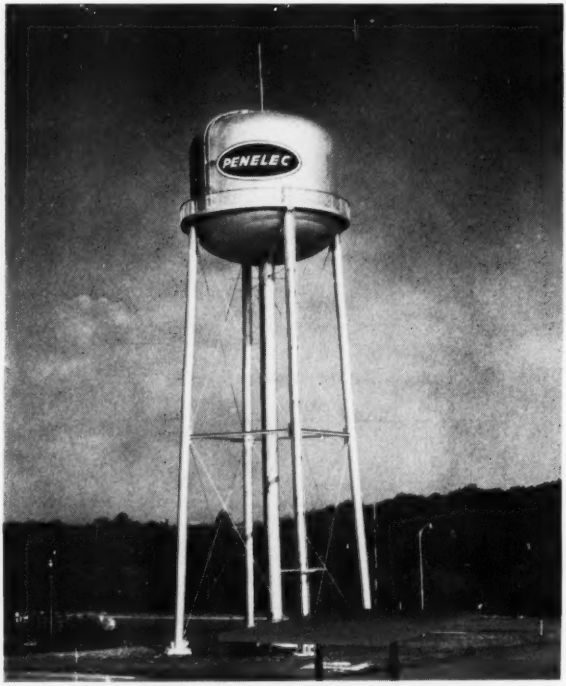
Offices

Atlanta
Birmingham
Boston
Chicago
Cleveland
Detroit
Houston
Kansas City, Mo.
New Orleans
New York
Philadelphia
Pittsburgh
Salt Lake City
San Francisco
Seattle
South Pasadena
Tulsa

Plants

Birmingham
Chicago
Greenville, Pa.
New Castle, Del.
Salt Lake City

IN CANADA:
Horton Steel Works Limited

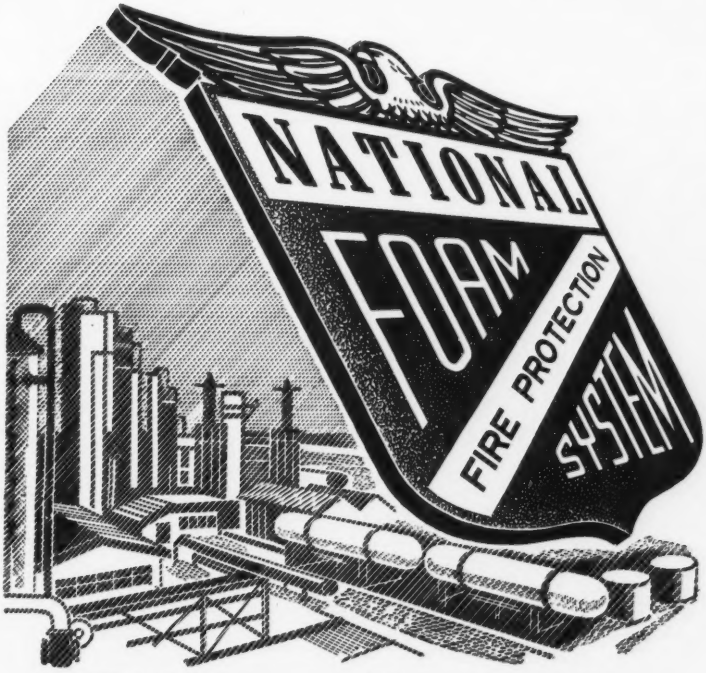


Horton Tank Helps Realize $9,000 Insurance Saving

An insurance saving of approximately $9,000 a year is realized through the installation of a sprinkler system and a Horton ellipsoidal bottom elevated steel tank.

The sprinkler system protects the service wing of the $2,300,000 Service Center of Pennsylvania Electric Company, Erie, Pennsylvania. This Center serves a 1,762-square mile area and consolidates all company activities formerly conducted in six different locations.

The tank, 28 feet in diameter by 75 feet to the bottom capacity line, stores 100,000 gallons of water, of which 75,000 gallons are reserved for fire protection and the balance used for domestic service.



Shielding your plant from fire . . . through developing new AER-O-FOAM formulas to meet changing needs

Thanks to technical advances in foam formulations, control of fire in flammable liquids is far more efficient than it used to be.

In many of these advances, National Foam has led the way. Available today are AER-O-FOAM liquids that produce twice the volume of fire-fighting foam . . . while resisting freezing at far lower temperatures.

In the future, as in the past, look to National Foam for fire-fighting products that meet the *current* needs of safety engineers!

NATIONAL FOAM System, Inc.
West Chester, Pa.

VICTAULIC

METHOD OF PIPING

VICTAULIC COUPLINGS

Styles 77, 77-D for standard applications. Simple, fast to install — sturdy and reliable. Sizes ¾" to 30". Style 75 Light-Weight Couplings for light-duty applications. Sizes 2" to 8". Additional styles for cast iron, plastic and other pipes. Sizes through 60".

ROUST-A-BOUT COUPLINGS

Style 99 for plain or beveled end pipe. Best engineered, most useful plain end joint on the market. Simple, husky — easy and fast to install. Takes strong bull-dog grip on pipe. Sizes 2" to 12".

VICTAULIC FULL-FLOW FITTINGS

Complete line of Elbows, Tees, Reducers, Laterals, etc. — to fit all Victaulic Couplings. Streamlined for top efficiency, easy to install. Sizes ¾" to 12".

VIC-GROOVER TOOLS

Handy, on-the-job grooving tools that do the job in half the time. Light weight, easy to handle — operate manually or from any power drive. Automatic groove position and depth. Sizes ¾" to 8".

APPROVED BY:

Underwriters' Laboratories, Inc.
Factory Mutual
New York City Board of Standards and Appeals, Cal. #413-53-SM.

Proven for 28 years on both wet and dry Fire Protection Systems. Standard with most major sprinkler companies for bulk-run and cut-in piping. Victaulic Couplings are installed in *less than one-half the time* required for other standard pipe joints.

THE EASIEST WAY TO MAKE ENDS MEET

VICTAULIC

COMPANY OF AMERICA
P.O. Box 509, Elizabeth, N. J.

Armed

for your complete fire protection!

These famous brands, consolidated under a single organization, comprise the most complete line of fire protection products and services ever offered. Representatives of each of these brands are armed with dependable equipment, application experience and professional services to guard you against every fire hazard.

This high-quality, competitively-priced equipment includes approved fire extinguishers; automatic sprinkler systems; carbon dioxide, dry chemical and foam systems; fire hose, nozzles and couplings; industrial and municipal fire alarm systems; and accessory fire department supplies including ladders, sirens, clothing, breathing apparatus, first aid kits, etc.

Look for these famous brand names, sold through fire equipment specialty firms and leading industrial distributors. Consult the yellow pages of your telephone directory under "Fire Protection Equipment" or write to The Fyr-Fyter Company, Dayton 1, Ohio.

THE FYR-FYTER COMPANY • DAYTON 1, OHIO

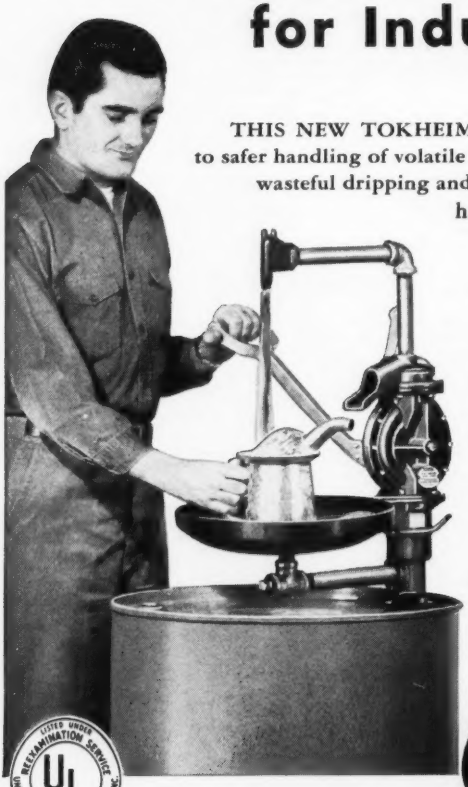
BRANCHES

ATLANTA	DALLAS	NEWARK	ROCHESTER
BALTIMORE	DETROIT	PHILADELPHIA	SAN FRANCISCO
BOSTON	LOS ANGELES	PITTSBURGH	SEATTLE
CHICAGO	NEW YORK	PORTLAND	HAMILTON, ONT.

REPRESENTATIVES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

SAFER

liquid handling for Industry



THIS NEW TOKHEIM HAND PUMP contributes to safer handling of volatile liquids wherever used. Stops wasteful dripping and slippery floors. Reduces fire hazard and accidents common to other methods of liquid transfer. Approved for handling petroleum liquids —ideal for many others. Available in 22 different models for 'most any use— from pipe lines to drums, or underground tanks, with hose or spout outlets. Order from your dealer, your oil company, or your Tokheim representative.

Write factory for literature.

LISTED UNDER RE-EXAMINATION SERVICE UL UNDERWRITERS' LABORATORIES, INC.

QUALITY TOKHEIM HIGH VACUUM HAND PUMPS

General Products Division

TOKHEIM CORPORATION

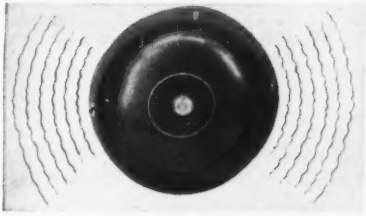
DESIGNERS AND BUILDERS OF SUPERIOR EQUIPMENT

1686 Wabash Avenue *SINCE 1901* Fort Wayne 1, Indiana

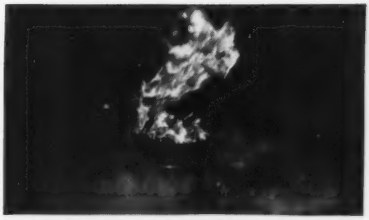
Factory Branch: 1309 Howard St., San Francisco 3, California

Canadian Distributor: H. Reeder, 205 Yonge Street, Toronto

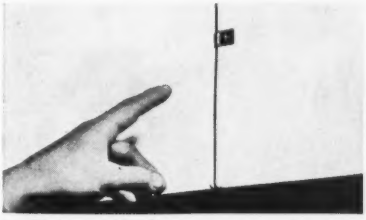
FIRE ALARM!



1. Save priceless lives, protect valuable buildings with the Kidde Atmo Fire Detecting and Alarm System!

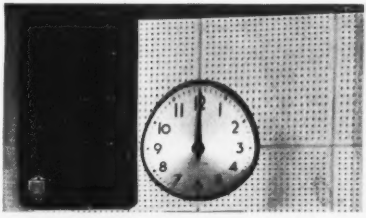


2. This automatic detecting and warning system sounds an alarm instantly at the *first* hot breath of fire!



3. Using rate-of-temperature-rise tubing as a sensing element, the system works without outside power!

4. Kidde's Atmo system can sound alarm at fire area, outside the building or at local fire department station!



5. Kidde's Atmo system also gives fire location at a panel near any manned telephone switchboard!

Kidde Atmo
FIRE DETECTION
J. H. SCHARFF, INC.
751 Main Street, Orange, N. J.
A Subsidiary of
Walter Kidde & Company, Inc.

For fast, dependable fire detection and warning, install a Kidde Atmo Fire Alarm System. Ideal where life protection and early fire warning is essential, the Kidde Atmo system can also close doors, shut off fans, motors, blowers, is automatically re-setting after use or test. Get more information! Write today and ask for Kidde's Atmo Alarm Systems booklet!

STARGARD

GIVES YOU MORE — FOUR WAYS

UPRIGHT SPRAY SPRINKLER

PENDENT SPRAY SPRINKLER

APPROVED BY
FACTORY MUTUAL LABORATORIES

SIDEWALL SPRINKLER

LISTED BY
UNDERWRITERS' LABORATORIES, Inc.

SMALL ORIFICE SPRINKLER
(With Identifying Pintle)

1 **SUPERIOR PROTECTION** . . . due to more efficient water distribution. Proven by tests under actual fire conditions for all classes of hazards.

2 **MORE EFFECTIVE USE OF LESS WATER** . . . because wider distribution and break-up of the water discharged provides greater cooling and extinguishment.

3 **CEILING PROTECTION BY COOLING — NOT WETTING** . . . All the water goes onto the fire. The break-up of water results in complete cooling and control of flammable vapors.

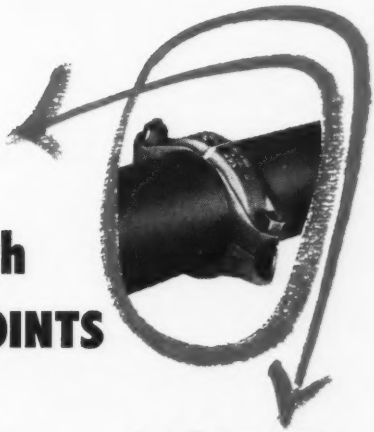
4 **MORE FIRE CONTROL WITH FEWER SPRINKLERS** . . . because ceiling temperatures are kept lower, fewer sprinklers open. Immediate water saturation of the fire area prevents the spread of fire. Hot gases become impotent in the cooled atmosphere.

STAR SPRINKLER CORPORATION

Westmoreland & Collins Sts., Phila. 34, Pa.

Licensees in principal cities of the United States and Canada

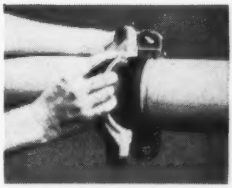
Couple Pipe the Easy, Low Cost Way with New G-B GRUVAJOINTS



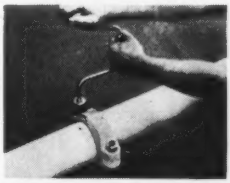
Now you can save up to 25% when connecting pipe for bulk runs and risers. Yes, contractors are saving money every day when they use new lightweight Gruvajoints. There's no flanging, no threading, no welding, and there's no need for heavy chain tongs or pipe wrenches. Gruvajoints are truly the modern way to couple pipe. Write today for free illustrated brochure on G-B Pipe Coupling Products. Gruvajoints are now available in 2", 2½", 3", 4", 5", 6" and 8" sizes.

Install Gruvajoints in three easy steps

Grease gasket and center over pipe ends.



Lay housing halves into grooves and insert bolts.



Tighten the two nuts equally.

LISTED by
Underwriters' Laboratories, Inc.
File EX 1741A and B

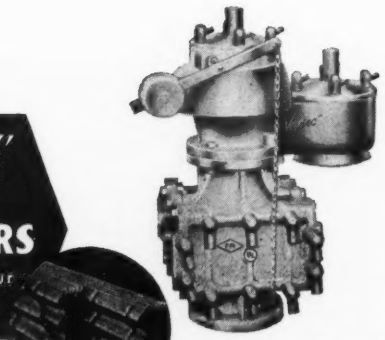
APPROVED by
Factory Mutual Engineering Division
Report Serial No. 13097

GUSTIN-BACON
manufacturing company
210 W. 10th St. Kansas City, Missouri

LOW COST
FIRE & EXPLOSION PROTECTION

for FLAMMABLE LIQUID STORAGE

WITH "Varec"
FLAME ARRESTERS
in combination with your
VENT VALVES



Flame Arrester Unit
listed by
UNDERWRITERS' LABORATORIES
Approved by Associated Factory Mutuals Laboratories and other governing agencies.

Fig. No. 5800A
Conservation Vent Unit consisting of VAREC Vent VALVE in combination with VAREC FLAME ARRESTER

You can rely on VAREC CONSERVATION VENT UNITS to provide full fire protection on your liquid storage at low cost. Protection against entry of flame through the venting device is certain when Varec Flame Arresters are used. Protection against excessive pressure or vacuum is assured by the VAREC VENT VALVE. The combination unit gives you complete security against major hazards of flammable liquid storage. Average installation costs 1/10th of 1% of your investment in tank and products. Secure full details from your VAREC Representative or write factory.

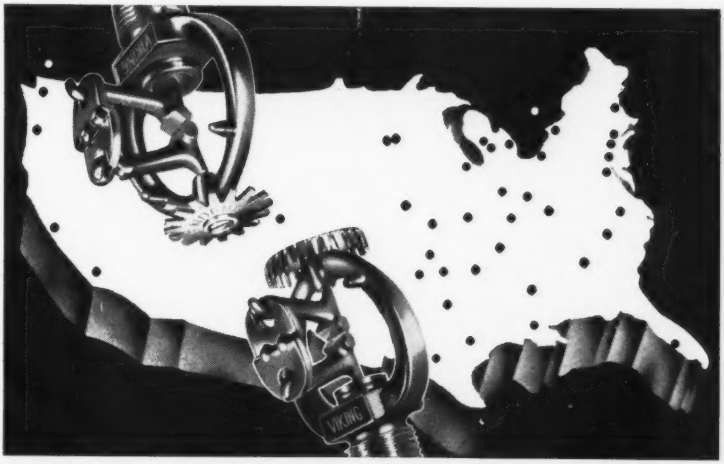
NF-3

"Varec"

THE VAPOR RECOVERY SYSTEMS COMPANY

COMPTON, CALIFORNIA, U. S. A.

Cable Address: VAREC COMPTON USA
(All Codes)



VIKING FIRE PROTECTION

For fire control whatever it happens to be, call the nearest Viking Representative

ATLANTA — Crawford & Slaten Co. **BOSTON** — Viking Automatic Sprinkler Co. **BUFFALO** — Viking Automatic Sprinklers, Inc. **CHICAGO, MILWAUKEE** — Viking Automatic Sprinkler Co. **CINCINNATI, CLEVELAND, INDIANAPOLIS, LOUISVILLE** — Viking Sprinkler Co. **DALLAS, HOUSTON, JACKSON (Miss.), MEMPHIS, NEW ORLEANS, N. LITTLE ROCK, SAN ANTONIO, FT. SMITH, TULSA** — Texas Automatic Sprinklers Inc. **DETROIT** — Viking Sprinkler Co. **GRAND RAPIDS** — Viking Sprinkler Co. of Western Mich. **HIGH POINT, N. C.** — Viking Sprinkler Co. **HUNTINGTON, W. VA.** — C. W. Hutchinson, Inc. **DECATUR (Ill.), DENVER, KANSAS CITY (Kan.), OMAHA, SAINT LOUIS, WICHITA** — Walton Viking Co. **LOS ANGELES, SAN FRANCISCO, PHOENIX** — California Viking Sprinkler Co. **HILLSIDE (N. J.), NEW YORK, MANCHESTER (Conn.)** — Viking Sprinkler Co. **PHILADELPHIA, WASHINGTON (D. C.)** — Viking Sprinkler Co. **PORTLAND (Ore.), SEATTLE, VANCOUVER (B. C.)** — Viking Automatic Sprinkler Co. **ST. PAUL, MINNEAPOLIS** — Hudson Viking Sprinkler Co. **TAMPA** — Florida Fire Sprinklers, Inc. **TORONTO (Ont.)** — Viking Automatic Sprinklers, (Canada) Ltd. **HASTINGS, (Mich.)** — The Viking Corporation.

the VIKING corporation

HASTINGS, MICHIGAN

AER-VENT SERVICE

Duct Cleaning and Fireproofing

BONDED — LICENSED — REGISTERED — INSURED

For INDUSTRIAL CLEANING of:

Air Conditioning Systems — Kitchen Exhaust Systems — Grease Ducts — Canopies — Hoods — Fans — Direct Exhaust Systems — Toilet Exhaust Systems — Wall Washing — Pipe Shafts — Elevator Shafts — Furnaces — Boilers

(Cleaning and associated processes are called fireproofing in this trade)

Aer-Vent Service
E ffective, cooler, air conditioning systems
Reduced redecorating costs & fire hazards

Ventilation for health
Exhaust and kitchen canopies like new
No mess during cleaning
Time — day or night

Satisfaction guaranteed
E stimates free
Reliable workmen
Verifiable reputation
Insured & licensed
Certified & bonded
E xcellent references

Our Clients Include

F. W. Woolworth Co. Minneapolis District
F. W. Woolworth Co. Denver District
Cargill, Inc.
F. H. Peavey & Co.
Union Pacific R.R.
First Service Corp.
Schimmel Hotels
John J. Grier Co.
Madison, Wis. Tel. Co.
Mutual of Omaha
O. H. Stocke & Co. Mayo Clinic
Kahler Hotel Rochester
Northwestern Bell Tel. Co.
Scott-Atwater Mfg. Co.
Mpls. Grain Exchange
Greyhound Post Houses

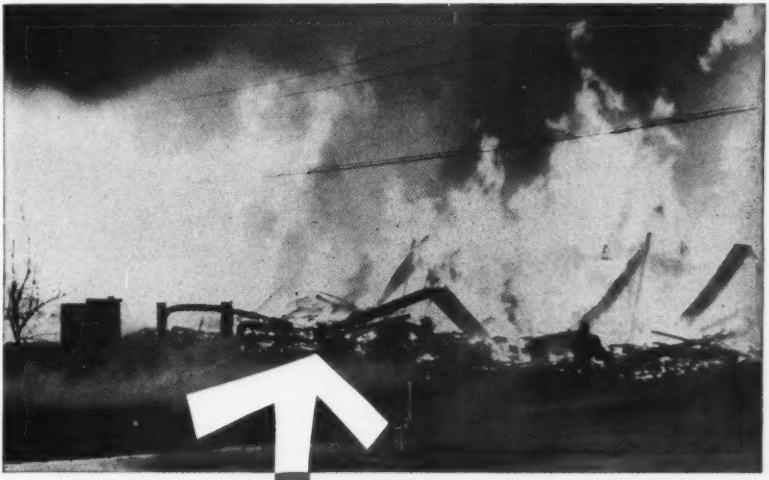
NATIONWIDE SERVICE AVAILABLE
Now covering Minnesota, Iowa, Kansas, Nebraska, North & South Dakota and Wisconsin

Call or Write AER-VENT SERVICE:

239 Hamm Bldg.
St. Paul 2, Minn.
Capital 2-3637

253 Plymouth Bldg.
Minneapolis 3, Minn.
Federal 3-5301

320 W.O.W. Bldg.
Omaha 2, Neb.
Harney 8600



this was so unnecessary

A Blaw-Knox Automatic Sprinkler System could have prevented it

Most uncontrolled fires are unnecessary. The damage in property destroyed, plants lost, inventories wiped out, records ruined, and businesses shut down can never be recovered. A Blaw-Knox *Automatic* Sprinkler System can stop fires at their origin, minimize damage to a small area, and pay for itself in a few years by savings in reduced insurance premiums.

"Little Joey Sprinkler" always on the job.

BLAW-KNOX COMPANY

Automatic Sprinkler Department
Power Piping and Sprinkler Division
829 Beaver Avenue, Pittsburgh 33, Pa.

NEW IMPROVED GRIMES MODEL AB SUPER ACCELERATOR

SPEEDS UP DRY PIPE VALVE OPERATION

ALL BRONZE

EASY TO INSTALL

SIMPLE TO SERVICE

FIRE SPRINKLER SYSTEMS AND EQUIPMENT

Engineered for better protection

ALARM VALVES
WATER MOTORS
VALVE DEVICES
DRY PIPE VALVES
RETARD CHAMBERS
CIRCUIT CLOSERS
EMERGENCY CABINETS
TRIMMINGS
SPRINKLERS — ALL TYPES AND FINISHES

THERE IS A GRIMES LICENSED REPRESENTATIVE NEAR YOU WHO IS EQUIPPED TO DESIGN AND INSTALL A FIRE SPRINKLER SYSTEM TO MEET YOUR SPECIFIC NEEDS.

GRIMES DEVICES ARE APPROVED BY ALL INSURANCE INTERESTS

RAISLER
SPRINKLER DIVISION

RAISLER CORPORATION, 129 Amsterdam Ave., New York 23
Licensees in all principal cities in the United States and Canada

Both vents are your Responsibility... and One can mean trouble!!

Every gas vent must be checked against local building codes. Give extra attention to those gas vents that fail to show the red-and-black Metalbestos "Safety Seal" above the gas appliance's draft hood.

The "Safety Seal" means an all-Metalbestos vent, installed according to the Metalbestos "Safety System" Tables. It means your responsibility for your neighbors' health and safety has been met by the installer's choice of vent pipe and installation method.

Look for the Metalbestos "Safety System" Seal... your assurance of scientific, safe gas venting.

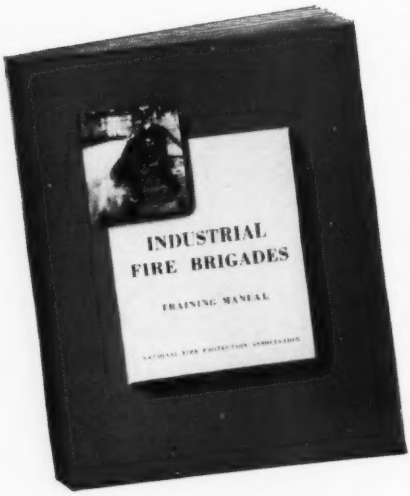
For your complimentary copy of the new "Safety System" Installation Guide, contact your nearest Metalbestos representative or write Dept. T-7.

Stocked by principal jobbers in major cities. Factory warehouses in Akron, Atlanta, Dallas, Newark, Des Moines, Chicago, New Orleans, Los Angeles, Woodbridge, N. J.

METALBESTOS DIVISION
WILLIAM WALLACE COMPANY · BELMONT, CALIF.

NFPA

INDUSTRIAL FIRE BRIGADES Training Manual



Fire Fighting "Know-How" for the men in YOUR Plant

160 pages and 385 illustrations

Printed on fine, glossy paper. 8½ by 11 inches page size. Expensive sewed binding, so book opens flat. 2 color paper cover.

Single copies **$3.25**

QUANTITY prices on orders to one address: 25 or more $2.45 each.

These subjects are covered and well illustrated:

- Plant Fire Protection
- Fire Causes and Hazards
- Making Forcible Entry
- Handling Rope
- Using Fire Extinguishers
- Handling Ladders
- Handling Hose
- Producing Effective Fire Streams
- Salvage Practice
- Rescue Work
- Inspection of Equipment
- Fire Fighting

Order from:

NATIONAL FIRE PROTECTION ASSOCIATION
INTERNATIONAL
60 Batterymarch St., Boston 10, Mass.

Nuclear energy takes over the fire watch...

Today's fire departments are composed of highly trained men with powerful equipment . . . but to put that equipment effectively to work they must be warned of fire in time! Now, nuclear energy, applied to electronics, gives them the vital extra minutes they need. Because PYR-A-LARM's nuclear heart reacts to the *invisible* products of combustion, it flashes the alarm long before conventional thermal detectors can function—before heat and flames build up!

We will be happy to arrange for you to witness an actual demonstration of PYR-A-LARM in your office, or send you complete information. *Approved by Underwriter's Laboratories Inc. and Factory Mutual Laboratories.*

these are some of the firms that have installed **PYR-A-LARM**

U. S. Department of the Navy
New York City Transit Authority
National Broadcasting Co.
Convair Div., General Dynamics Corp.
Tung-Sol Electric, Inc.
The Glenn L. Martin Co.

PyroTronics
A DIVISION OF BAKER INDUSTRIES, INC.

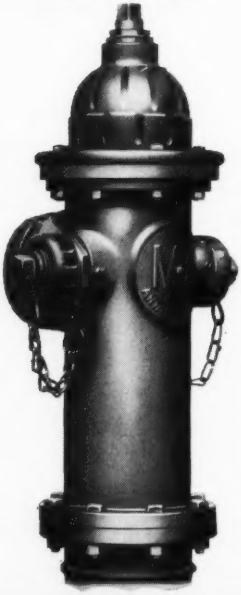
NUCLEAR FIRE DETECTION AND ALARM SYSTEMS
P. O. Box 390, Newark 1, New Jersey

ALWAYS-READY GUARDIAN OF *LIFE* AND *PROPERTY*

MH

COMPRESSION TYPE FIRE HYDRANT

Above: Standard Model.
Below: Traffic Model.

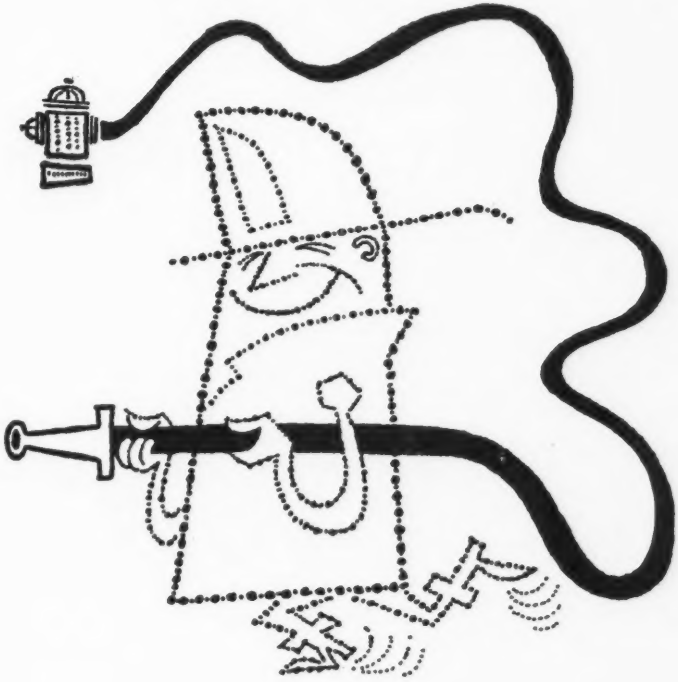


Although an M & H Fire Hydrant may stand idle for years, without a moment's notice it functions perfectly. Its simple rugged design and careful manufacture from highest quality materials is the reason.

Large diameter, unobstructed waterway gives high flow efficiency when large volume of water is needed to fight fire. All operating parts are bronze or bronze bushed. Furnished either in accordance with A. W. W. A. specifications or Underwriters and Factory Mutuals approved; also either standard model, traffic model or flush type. For complete information, address

M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

SUBSIDIARY OF W WALWORTH



HEED THE FIRE FIGHTERS' ADVICE

Your local fire department performs a great public service by protecting you and your community from fire. They expend great efforts to teach fire prevention to the public.

Heed the fire fighters' advice. Protect your buildings from fire. For assured building fire protection specify a Lexsuco Fire Retardant Roof Construction. It has been tested and classified Class I by Factory Mutual.

Write today for information.

LEXSUCO INC BOX 326 • SOLON, OHIO

New Design Sprays Water More Evenly Over Wider Area!

It's hard to improve on the best, but we've done it! By re-designing our already superior "Automatic" Spray Sprinkler, we have come up with a model that has an even *better* distribution pattern. We also made the casting more rugged. The resultant increase in efficiency means better performance in case of fire. While we were at it, we improved our sprinkler's appearance.

Available for upright or pendant installation.

Ask your nearest "Automatic" Sprinkler fire safety engineer or write to us for complete information.

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN, OHIO
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

"Automatic" Sprinkler

FIRST IN FIRE PROTECTION

Don't Overlook the Connecting Link

The connecting link between the private fire alarm system or sprinkler system and City Fire Department is the Master Box.

Your fire losses are beyond the curb line. And you aren't getting 100% value from your alarm system unless your city circuits are interconnected through the Master Box to industrial plants, schools and public buildings.

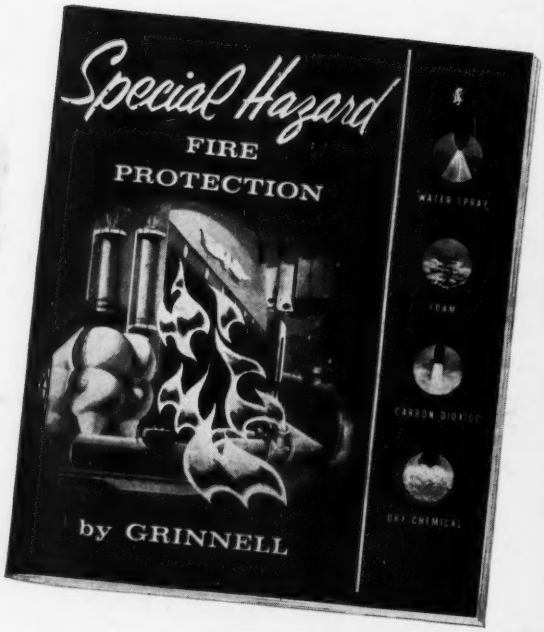
Protect yourself and your citizens *all the way*. Close up the gap. Remember, you depend on industry — it's up to you to protect it.

GAMEWELL

THE GAMEWELL COMPANY, Chestnut St., Newton Upper Falls 64, Mass.

In Canada: Northern Electric Co., Ltd., Belleville, Ontario

Send for your FREE COPY of this new reference manual!



THIS NEW 44-page manual — "Special Hazard Fire Protection by Grinnell"— has been prepared to give you a comprehensive picture of the most advanced methods for Special Hazard fire protection. It includes descriptions, applications, case histories of Grinnell systems and specialized equipment . . . and a Quick Selector Chart to help you determine the most effective and economical system for your special fire hazard.

To learn more about fire, and the most recent methods of extinguishing it, send for your complimentary copy of this new, informative manual. Write Grinnell Company, Inc., 277 West Exchange St., Providence, R. I.

TABLE OF CONTENTS

- Recognizing Your Special Hazards
- The Fire Triangle in Special Hazard Fire Protection
- Special Hazard Fire Terms Defined
- Water Spray Systems
- Selfcon Water Spray Systems
- Foam Systems
- Carbon Dioxide Systems
- Dry Chemical Systems
- Control Equipment and Devices
- Quick Selector Chart
- Research and Testing
- Sales, Engineering, Installation and Inspection Service

GRINNELL

WHENEVER FIRE PROTECTION IS INVOLVED

Manufacturing, Engineering, and Installation of Fire Protection Systems Since 1870